Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. LI. NEW YORK, SATURDAY, APRIL 25, 1908. No. 17.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

JAMES H. McGRAW, President.
J. M. WAKEMAN, 1st Vice-President. A. E. CLIFFORD, 2d Vice-President.
CURTIS E. WHITTLESEY, Secretary and Treasurer.

239 WEST THIRTY-NINTH STREET, NEW YORK.

TELEPHONE CALL: 4700 BRYANT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE.....590 Old Colony Building
CLEVELAND OFFICE.....1015 Schofield Building
PHILADELPHIA OFFICE.....Real Estate Trust Building
EUROPEAN OFFICE.....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION:

United States, Cuba and Mexico.....per year, $3.00
Dominion of Canada.....4.50
Other Foreign Countries within the Postal Union.....6.00
25 shillings 25 marks 31 francs
Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies of issues prior to January, 1907, are kept on sale, except in bound volumes. Subscription orders being renewable at the end of the month indicated on the wrapper, the sending of remittances on or before that date will be much appreciated by the publishers.

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Entered as second-class matter at the post office at New York, N. Y.

The circulation of ELECTRICAL WORLD *for 1907 was 951,250 copies, an average of 18,294 copies per week. Of this issue 15,500 copies are printed.*

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OVERSHOOTING OF TUNGSTEN INCANDESCENT LAMPS.

When we connect a carbon-filament lamp of the ordinary non-graphitic type to constant-potential mains, the initial resistance of the filament is about twice the resistance at the final working temperature, and hence the initial heating power developed in the filament is only about half the final steady heating power. This condition prolongs the interval of temperature elevation in the filament, or the interval between closing the lamp circuit and the attainment of substantially full incandescence. This period is, however, very short under practical conditions, being only a fraction of a second, but it is appreciable to the eye. The eye recognizes that there is a rise in brilliancy, or that the brilliancy is less at first perception than after the first second. In the case of a metallic-filament lamp, and particularly in the case of a tungsten-filament lamp, the initial resistance may be five times less than the resistance at the final working temperature. Consequently, the initial heating power developed in the filament may be about five times the final steady power. On this account the filament comes up to full incandescence in a much shorter period, or much smaller fraction of a second than in the case of the carbon-filament lamp. If we close the circuit of a tantalum, osmium or tungsten lamp, we fail to detect any initial defect in brilliancy. The first effect of which we are aware is full brilliancy.

In an articles on page 859 Mr. John B. Taylor describes the above-mentioned conditions, and goes further. He reports that the first brilliancy detected is actually greater than the final steady brilliancy of the tungsten lamps examined, a phenomenon which he names "overshooting." We have not been able to satisfy ourselves as to the objective existence of this phenomenon in experiments with the unaided eye on such tungstens or tantalum lamps as we have at hand. However, the article describes certain photographic evidence to show that the initial candle-power is greater than the final candle-power, and if such experiments are properly made, they are competent to settle the question of fact. We think, however, that the experiments should be repeated by other observers with success before we are justified in accepting the fact as established, because we all know that sensations received from the retina are not reliable when they are undergoing rapid variation. Assuming the proposition to be established experimentally that there is an initial overshooting of temperature and luminescence in tungsten lamps under certain conditions, the explanation is to be looked for either in the initial electrical actions—that is, in the initial circuit conditions—or in the initial radiation conditions of the filament. Unless the resistivity of the filament has a time lag, a very difficult idea to frame, the rising temperature should automatically cut down the power in the filament, and prevent overshooting. It is conceivable that on an alternating-current circuit, such as is described in the article, the presence of inductance in the lamp circuit might tend to check the first inrush of current and also to carry over the current when the

resistance increased. Any such inductive effect would probably be limited, however, to a single cycle, or sixtieth part of a second, whereas the report is that the overshooting has a duration of the order of one-tenth of a second. If the effect were due to inductance, it would not be found on direct-current circuits. The explanation suggested in the article is an initial variation in the radiation conditions. This might be determined by experiments in the laboratory before the lamp is sealed off, and while the degree of evacuation is still measurable. At all events, the subject is well worth investigation, even although it does not seem to be of great practical importance.

Concerning Luminous Arcs.

Mr. Dyott's article, printed elsewhere in this issue, and dealing with some of the idiosyncrasies of the magnetic arc, points a somewhat extensive collection of morals. Chief among them stands the necessity of something like a scientific study of luminous arcs, of something going beyond the production of a salable arc, of some manner of general understanding of the principles underlying the performance of such arcs. This is all the more important since it is at the present time entirely clear that the old carbon arc is doomed, and will soon be replaced by some form of arc, perhaps by a form different from any now in commercial use. The fact is that the ordinary carbon arc, so far as light-giving power is concerned, is not an "arc" lamp at all, but an incandescent lamp giving its light in virtue of the enormous temperature of the crater. The arc is merely incidental to the production of this crater and itself is only feebly luminous. The modern arcs of all kinds derive most of their light from the arc itself rendered luminous in and of itself, and receiving comparatively little assistance from whatever crater may exist. It is this radical difference in operation that makes the new arcs of such revolutionary importance. So long as the source of light is a solid incandescent body, so long will the spectrum of that light be continuous with its energy maximum in the non-luminous infra-red and a large part of the visible radiation in slightly luminous red and blue. There hardly seems to be a fighting chance of pushing any incandescent solid to a temperature high enough to push its energy-maximum into the visible spectrum, let alone the advantageous part of it.

The "flame" arcs, on the other hand, give the discontinuous spectra of vapors. In such spectra there is no known relation between the position of the energy-maxima and the temperature. It is quite within the range of possibility to have this maximum in the violet or even the ultra-violet. Hence in a flame arc the energy maximum may, and in some cases does, lie in the part of the spectrum where it will do most good. In choosing a substance, therefore, for loading the electrodes of a flame arc, one must be selected of which the spectrum is very strong within the highly luminous part of the visible spectrum in order to reach high efficiency. To get a good color, however, the electrode-vapor must have a spectrum not mainly confined to the highly luminous yellow and yellow-green, but having a considerable admixture of the weakly luminous red and blue-violet. The highest luminous efficiency is therefore incompatible with a color approximating white and such is found to be the case in practice. The common yellow flame arc of which the electrodes are charged mainly with calcium fluoride, has a spectrum especially intense in the yellow and green and has, therefore, an enormous luminous efficiency, while any admixture that brings the color near to white considerably reduces this efficiency. On the other hand, the titanium flame arc, which gives an admirably white light, has a luminous efficiency not materially higher than can be reached by an open carbon arc pushed to high-current density, although, of course, it is much superior in efficiency to the ordinary enclosed arc. In the new arcs one has, therefore, to face a compromise between efficiency and color-value, a compromise which has not yet been properly adjusted, at least for interior lighting.

Another difficulty is found in the character of the products of combustion. Carbon is one of the few solid elements which oxidizes into a colorless and inoffensive gas. All the materials used in the present flame arcs oxidize into solid particles which, while adding something to the light by their incandescence, produce a smoke which must be disposed of by a draft of some sort lest it render the globe opaque. The more volatile the substance of the electrodes the more débris must be taken care of, and the harder the arc is pushed to win efficiency the worse the problem of disposing of the products of combustion. If the electrodes are charged with a mixture, its several components must be of similar volatility else they will tend to separate and produce such changes in the arc as Mr. Dyott describes in the case of his electrodes. This condition forbids the use of many mixtures which might otherwise be desirable for improvement of the color values. Also, as is suggested by Mr. Dyott's investigations, the electrode substance must be such as will vaporize smoothly and regularly without the formation of any troublesome slag to interfere with the steadiness of the arc. Here also is a condition which may prohibit the employment of substances otherwise desirable. If a flux is to be used to escape the difficulty, it must be one which will not interfere in other ways with the general performance. In spite of all these things the flame arc has made such progress as to put the carbon arc on the road to obsolescence, so that the array of difficulties suggests achievement rather than discouragement. The distribution of light from the flame arcs varies very widely, but is more a matter of design than of electrode material. Any vertical flame arc worked at low current density so that there is no localized region of extreme temperature at the electrodes, gives of necessity a strong lateral distribution, the flame acting as a short vertical luminous pencil. Hard pushed, so that there is enormous activity at the electrode surface, the radiation from that surface increases, giving more light axially.

Another matter not yet satisfactorily settled is the life of the electrodes. In general terms, the more incandescent vapor the greater the light and the shorter the life. The earlier flame arcs of the calcium fluoride type gave conspicuously short life of the electrodes, rather too short for convenience, in fact; requiring electrodes about a foot and a half long for a dozen hours of life. The lamps of the magnetite and the titanium class, on the other hand, have been developed especially for long life, giving a hundred hours or so for one pair of electrodes, but at very modest efficiency compared with the others. Now, as regards trimming, there is a great deal of misappre-

hension. The actual labor cost of trimming is altogether trivial. In the later days of the old open arc many a company kept its trimming figure down to two cents per trim, and some companies reported less than this, as a glance at old N. E. L. A. discussions will show. Gaining long life at considerable sacrifice of efficiency is justifiable economically only when the cost of the electrodes is a serious matter. It is to be noted that it will be practicable to produce electrodes for flaming arcs which give a better compromise between life and efficiency than those now in use. A thorough search over the list of the chemical elements for improved material ought to be productive here, as it was in the case of incandescent lamps. And given an electrode of suitable life and efficiency, there is still one important qualification to be looked for. Any very efficient arc for maximum usefulness should be available in convenient units. One could, say, double the light from our ordinary arcs to great advantage, but a large further increase for the same energy is less useful than a more modest increase for the same or reduced energy. So far the movement in this direction has been less productive than one could wish, because most of the smaller arcs have been secured at the same voltage as heretofore and great relative reduction of current, so that the distribution problem is not at all simplified. More current, to insure stability and lower voltage at the arc, would give a more valuable combination of qualities.

Decorations in Gas-Lighted Rooms.

In districts where natural gas at from 30 to 50 cents per 1000 cu. ft. is available, the cost of lighting with the use of gas mantle burners is insignificant so far as the simple cost of the gas consumed is concerned. In fact, it can almost be left out of account in figuring the actual total cost of lighting by this method. Even where artificial gas at $1 per 1000 is used, the cost of gas for producing a given number of lumens is very much less than with carbon-filament lamps as commonly used in residences to-day. With the application of good illuminating engineering and lamps of recent high-efficiency types, the practical difference between electricity and artificial gas is reduced almost to zero so far as the light useful to the consumer is concerned. With natural gas it is useless to expect the cost of electricity to approach anywhere near that of gas in the immediate future. Nevertheless, in natural gas districts there is a remarkable indifference among residence owners to the introduction of natural gas lighting in their homes. There must be some good reasons for this and they are easy to find. To begin with, there is the match nuisance to which no one who has ever used electric light wishes to return.

Then there is the cost of mantles and the fact that mantles have a habit of breaking at inconvenient times, and unless used with more care than is ordinarily employed, nowhere near the rated life is obtained from a mantle. These, however, are the lesser of the troubles. The average house owner seldom sits down to figure yearly costs of redecorating over a term of years, and for that reason is more likely to forget the difference between gas and electric light in this respect than is the owner of large apartment and flat buildings who has this matter down to a science. Whether it is the air current created by the heat from the gas burner or whether it is the products of combustion from the gas itself, it is not necessary to inquire. The fact of the matter is that the owner of large flat buildings who has studied the subject knows that cost of papering and calcimining in gas-lighted rooms averages about double that for electrically-lighted rooms. With these practical figures as a starter, it does not take long to arrive at the conclusion that the difference in cost between electric and gas lighting, everything considered, is largely imaginary at the present time, and that the tungsten lamp will definitely swing the balance in favor of electricity.

The Non-Synchronous Generator in Central-Station Work.

The non-synchronous alternating-current generator and the synchronous converter are more closely related than appears at first sight, because the synchronous converter is a particularly appropriate adjunct to the non-synchronous generator. The non-synchronous generator, as is well known, is merely an induction motor inverted in its functions. If we drive the secondary rotor of an induction motor by an engine, and leave the stator primary disconnected from its mains, we merely revolve a squirrel-cage, low-voltage, short-circuited element without other loss than journal friction and windage. If, however, we close the primary windings on the main circuit, the torque produced on the engine will depend upon the conditions in the circuit at that moment. If alternating voltage is being maintained between the mains, there will be a rotating magnetic field set up in the stator, and exciting currents will be drawn from the mains to supply this. If the speed at which the rotor is running happens to be the same as the speed of the rotating magnetic field, then no other effect will be produced, and there will be no torque exerted on the engine. If, however, the speed of the rotor is slightly in excess of the speed of the rotating magnetic field—that is, if there be a small negative slip—then currents will be induced in both rotor and stator. The currents in the stator will have the frequency of alternation existing in the mains, and will be watt currents aiding in carrying the load on those mains. The currents in the rotor will have the slip frequency and will exert a resisting torque on the engine, or absorb power in the dynamo-electric way. At the same time the mains will be called on to supply an increased wattless current to the primary winding.

The advantages of non-synchronous generators in central-station work would lie in simplicity of generator rotor structure, high efficiency, absence of necessity for synchronous connection to mains, reduction in excitation owing to smaller air-gaps, reduction in the magnitude of surges following short-circuits, and absence of distortion in the e.m.f. wave form under load. The principal disadvantage of a non-synchronous generator so far as existing practice has revealed the matter, lies in its inability to carry a lagging current load; or to express the matter in another way, in its inability to furnish a magnetizing current. All it can do is to deliver current substantially in phase with the voltage between mains, provided that the slip is suitably maintained, and that a proportional wattless current is supplied to the primary from the mains in order to satisfy the magnetic leakage in the machine. All magnetizing currents must be supplied from the system, either in the form of condenser charging currents, or in the form of wattless components of current supplied by synchronous machines such as converters.

Long Acre Hearing.

At a continuation of the hearing before Commissioner Maltbie, of the New York City Public Service Commission, on application of the Long Acre Light & Power Company to issue bonds, which was held Tuesday, April 14, Mr. W. H. Knight, chief engineer of the Long Acre Company, handed a number of maps to the commissioner, which showed certain sections of the city and indicated the kind of illumination used in the buildings in the sections shown. The houses and stores which used both gas and electricity, and the buildings which used either form of lighting or none, were indicated. In all, 10 maps were submitted, which embraced tenement sections of New York, and which showed that electric lighting was decidedly in the minority as compared with gas lighting. Almost 100 blocks in all were covered by maps. Mr. Knight said he believed that under competition, electricity would be much more extensively used, as, for instance, in electric heating and electric vehicles, which are largely restricted at present by inadequacy of the present equipment and the present prices. He stated that with the invention and improvements of recent times the cost of light and power had, on the consuming end, i. e., the lamp end, showed a reduction of 200 to 300 per cent, due to increased efficiency of arc and incandescent lamps. He offered in evidence a schedule showing the cost at which light can be produced by the Long Acre Company, and the prices at which the company would furnish light and power to purchasers. The schedule reads as follows:

MOTORS AND STORAGE BATTERIES.

Not exceeding 200 kw-hours per month	8 cents
From 200 to 300 kw-hours per month	7 cents
From 300 to 500 kw-hours per month	6 cents
From 500 to 1000 kw-hours per month	5 cents
From 1000 to 10,000 kw-hours per month	4 cents
Over 10,000 kw-hours per month	3½ cents

ELECTRIC LIGHTING.

Basic rate, per kw-hour	8 cents
Deduction for an average daily use of 4 hours	1 cent
Deduction for an average daily use of 6 hours	2 cents
Deduction for an average daily use of 8 hours	2 cents
Deduction for an average daily use of 10 hours	4 cents

COST OF ELECTRIC POWER IN NEW YORK CITY.

	Per kw-hour.
Power house operation	.6 cent
Cost of power at customer's meter	.8 cent

GENERAL EXPENSES.

	Per kw per year.
Depreciation of power plant, conductors and substations, 3 per cent on $300	$9.00
Rental of ducts	10.00
General expense, legal, insurance, taxes, sales, collections, salaries, administration, etc	18.00
Interest 6 per cent on $300	18.00
Total fixed charges per kw per year	$55.00

FIXED CHARGE PER KW PER YEAR.

Taxes, 1.5 per cent on $300	$4.50
Insurance	.30
Administration and legal expense	6.00
Sales and collections	2.00
Meters, men and inspectors	1.00
Trimmers	.60
Printing, stationery and office expenses	.20
Advertising	.40
Franchise tax	2.00
Rents	.50
Miscellaneous	.50
Total	$18.00

Mr. Knight said that he attributed the large number of houses that have no electrical connections, as shown by the maps, to the indisposition on the part of the present suppliers of electricity to supply electric light when they have a satisfactory customer for gas. He believed that the electric light companies are restrained by the gas companies which own the stock of the electric companies. As shown by the maps, there were blocks and blocks without a single electric light. The Long Acre Company will offer special inducements to bring about the use of electric heaters, charging as for motor work and storage battery work. In answer to a question by Mr. Walker, Mr. Knight summarized the chief factors which are responsible for the inadequacy of the electric light supply in the city to-day. In the first place, he said, electric light is supplied by about one company, under no incentive to competition. Second, that company is interested in electricity's chief rival, gas—a form of illuminant, which while most desirable to the users is, perhaps, more desirable to the suppliers. Third, the growth of the city is so rapid and the growth of the art so rapid that it would be extremely difficult for any one company to properly occupy the field. Fourth, with more energetic canvassing, a more concentrated supply of electric current can be obtained, resulting in greater economy and a corresponding reduction in price, followed by a still greater increase in consumption. With that the Long Acre Company closed its case.

At the previous hearing Mr. Knight created considerable of a sensation by telling of a new lamp which the Long Acre Company will use. This lamp, he said, has twice the efficiency of the tungsten lamp and costs $1. It was not produced at the hearing, but was shown to the Commissioner in private. Information concerning the technical features of the lamp could not be obtained from Mr. Knight other than it was a non-filament lamp considerably larger than the ordinary incandescent lamp, and applicable to low-potential circuits and standard sockets. Mr. Knight intimated that the lamp possesses a therapeutic effect and has an indefinite life.

The only lamp that is at all comparable to the lamp which the Long Acre Company claims to control is the German quartz mercury-vapor lamp described in our issue of October 19, 1907. This lamp has a specific consumption of approximately 0.25 watt per candle and also has a very strong ultra-violet radiation, the effect of which is counteracted by glass screens which absorb this radiation. The quartz lamp, however, has not an indefinite life, nor is it a competitor of the incandescent lamp, it being intended to compete with high-candle-power arc lamps, the mean spherical candle power of two lamps tested being 2680 and 3110 respectively.

Overhead High-Tension System of the New York Central.

At a continuation last Thursday of the hearing on the overhead high-tension system of the New York Central R. R., held before Commissioner Eustis of the New York City Public Service Commission, Mr. E. B. Katte, electrical engineer for the New York Central, went into details as to the causes of death through electrocution on railways where there is possible contact with the third rail or with overhead wires. Other matters discussed were the number of extra ducts built by the New York Central, both for future expenses and for ventilation, the water-proofing of the ducts and the nearness of certain poles to the tracks. In certain instances it was brought out that the poles run so near the tracks that there was clearance room of only 2 ft. between the pole and the side of a passing car. Mr. Charles B. Martin, transmission engineer of the railroad, gave details of the estimate as to the cost of putting underground the present overhead wires and outlined the underground work construction done in Brooklyn by the Brooklyn Heights Railroad Company.

Annual Meeting of American Electrochemical Society.

The annual meeting of the American Electrochemical Society will be held in Albany, N. Y., April 30, May 1 and 2, with headquarters in Hotel Ten Eyck. The sessions of Monday will be held in the hotel, and in the evening the members will attend a lecture by Prof. W. D. Bancroft on "The Electrochemistry of Light," during which the lecturer will present a new electrochemical theory of light. The morning session of Friday will be held in the lecture hall of Union University of Schenectady, and the afternoon of that day will be passed in a visit to the General Electric Works. On Saturday a forenoon session will be held in the lecture room of the Rensselaer Polytechnic Institute at Troy, and the afternoon occupied in visits to industrial plants in Troy and vicinity.

Among the large number of papers on the program are the following having a more or less general electrical interest: Constructive and accurate measurement of resistances of the order

of 10,000 megohms, by Mr. H. L. Bronson; nature of the surface film formed on aluminum and magnesium, and the aluminum-magnesium cell, by Messrs. H. T. Barnes and G. W. Shearer; potential of the nickel electrode, by Mr. E. P. Schoch; corrosion of iron from the electrochemical standpoint, by Prof. C. F. Burgess; electrochemical corrosion of the Rochester steel conduit, by Mr. Richard H. Gaines; distillation of turpentine by electricity, by Mr. F. T. Snyder; Robert Hare's electric furnace, by Prof. C. A. Doremus; electrical testing of iron during annealing, by Prof. E. E. F. Creighton; passage of direct current through electrolytes without the use of electrodes, by Mr. Carl Hering; electrolytic refining of iron, by Mr. E. F. Kern; problems in the manufacture of dry cells, by Prof. C. F. Burgess.

Meeting of the New York Section of the Illuminating Engineering Society.

The meeting of the New York section of the Illuminating Engineering Society, held on April 9, was devoted to a discussion of the characteristic performance and commercial features of the new types of incandescent lamps, an illustrated lecture being given by Dr. Clayton H. Sharp.

Dr. Sharp outlined the various improvements that have been made in illuminants during the past 10 years, beginning with the work of Welsbach on the incandescent gas mantle. He explained the methods of manufacturing the 3.1-watt carbon lamp, the 2.5-watt graphitized-filament lamp, the 2.0-watt tantalum lamp and the 1.3-watt tungsten lamp. In comparison with the old carbon lamp the new tungsten lamp is not only more efficient, but it is less sensitive to voltage variation on account of its positive resistance-temperature coefficient. Thus for equal fluctuations in brilliancy of the two lamps, the tungsten requires only two-thirds as much copper in the distributing circuits as is necessary with the carbon lamp. Recent improvements in methods of manufacture have largely overcome the objectionable fragility of the tungsten filament.

Mr. S. E. Doane stated that the use of high-efficiency lamps has not tended to reduce the income of electric-lighting companies, because the consumers have preferred to increase the light at the same cost rather than to decrease the cost with the same light. Moreover, the new types of lamps have not caused the sales of the carbon lamp to decrease at least as greatly as in previous years. Although most of the new lamps are made in large candle-power units, progress is being made in smaller units. A 25-watt tantalum lamp will probably be introduced soon, while 20-watt tungsten lamps have been manufactured.

Dr. E. P. Hyde expressed the opinion that the higher luminous efficiency found in the newer types of incandescent lamps is due to selective radiation as well as to the increase in temperature. He stated that a certain lamp of the type shown by Dr. Sharp, with a carbon filament surrounded by mercury vapor, has consumed from eight to nine watts per candle when first connected to the circuit, while the illumination increased within a few minutes to such a value that the specific consumption reduced to from three to four watts per candle, although the actual power consumption was not changed.

Mr. W. J. Hammer called attention to the work done by Mr. John A. Heany, stating that the best tungsten lamps had been produced by this inventor. He attributed the results to purity of the tungsten used and to the high temperature at which the lamps are operated.

Mr. Arthur Williams said that he welcomed the advent of the high-efficiency lamps, because they tend to put electric lighting within the means of the poor man. An increase in lamp efficiency will result in a greater increase in the use of electric lights and lighting companies will be benefited by the improvement.

The chairman, Mr. W. W. Freeman, announced that the lecture by Dr. E. L. Nichols, which had been scheduled for the April meeting, will be delivered before the New York section on May 14. The subject of the lecture will be "Daylight and Artificial Light."

Central Georgia Power Plant.

The plant of the Central Georgia Power Company, to be situated on the Oconee, Ocmulgee and Flint Rivers, which drain the most populous and important industrial sections of Georgia will, when finally completed, cost $15,000,000 and have a capacity of 100,000 to 125,000 horse-power, the largest power development in the south, and one of the largest in this country. Of the several power sites to be developed, the one first selected is on the Ocmulgee River, seven miles east of Jackson, the county seat, and midway between Macon, with a population of 56,000, and Atlanta, which is 43 miles distant. The Macon Railway & Light Company, which owns the street and suburban railways of Macon, and furnishes all the electric lighting for Macon and the suburbs, is allied with the Central Georgia Company. In the city of Macon 12 lines of railroads focus, and in neighboring towns the cotton mills operate 227,211 spindles and 4715 looms, while there are many wood-working plants, railway shops, foundries, municipal and private waterworks and numerous other industries which require a large and constantly increasing amount of power. In the past the high price of coal has prohibited the use of electric power except to a limited extent. In a radius of 35 miles of this plant there is a population of 250,000 and a great number of large plantations devoted to cotton and corn, stock farms and extensive orchards. The resources of the Ocmulgee River are sufficient to supply power many times over for the proposed interurban electric railways between Atlanta and Macon, and Macon and Albany.

The proposed power site has a head of 100 ft., a storage basin of more than 3000 acres and natural rock foundations for a dam. At that point the river is 350 ft. wide, flowing through a hilly country with high bluffs on each side. The plan recommended and adopted provides for a concrete and masonry dam at the foot of the shoals, 1425 ft. long on the crest, and giving an effective head of 100 ft., which will back the water 15 miles, creating a storage reservoir area of 5 square miles. The power house of reinforced concrete and masonry will be situated on the western bank of the river, and built against the lower side of the dam and integral with it. The water will descend through large steel feeder pipes to the turbines, and the tailrace will empty directly into the river below the dam. Four turbines, direct-connected to four generators of 10,000-kw total capacity, will utilize the full power of the development and from the transformers and switchboard the 60,000-volt current will be carried by steel-tower transmission lines direct to Macon and the surrounding towns. This plant has a development of 10,293 horse-power under an average 90-ft. head per 18 hours per day in any year, and 12,727 horse-power under 100-ft. head per 24-hour day except during the summer months of an unusually dry season. The rates to be charged for power will be based on rates of the Niagara Falls Power Company, varying according to the average use (30 per cent load factor) from $22 to $33 per horse-power per year. The total cost of the complete development on the Ocmulgee River is estimated at $2,500,000. The estimated gross income is given as $417,000 and the total annual net income $332,000.

The Central Georgia Power Company was organized under the laws of the state of Georgia in March, 1907, under the name of the Ribb Power Company. Its officers are Mr. W. Jordan Marsee, president; Mr. John C. Walker, vice-president; Mr. M. F. Hatcher, secretary; Mr. J. T. Moore, treasurer, and Mr. Charles F. Howe, chief engineer. The banking firm of A. B. Leach & Company, New York, is financing the project with a $16,000,000 bond, $20,000,000 stock issue. It has not yet been decided whether the second section to be developed will be situated on the Flint or Oconee, but ultimately there will be power stations on the Ocmulgee River, the Oconee River and Flint River, and the total outlay will be between $15,000,000 and $20,000,000.

Japan's Manufacture and Importation of Electrical Machinery.

By M. Kawara.

The present financial depression, which came so suddenly, seems to have made manufacturers feel more keenly the necessity of extending their export business. It may not be inopportune, therefore, to refer to the situation of the electrical trade in Japan.

The first telegraphic apparatus in Japan was brought from this country by the famous Commodore Perry in his memorable expedition. On seeing its mysterious power of communication, the Japanese thought it was a magic instrument worked by the supernatural power of the "Western Devils," and cast it away. It was in 1868 that the first practical use was made of this apparatus. Since then the telephone, the electric light, the electric railway and the electric motive power have entered into general use one after another as each became adopted in America and Europe.

As the use of electrical machinery increased, enterprising manufacturers began to build simple apparatus, and this industry kept on growing each year, very slowly, however, as compared with other industries. Even as late as in 1904 the total number of private factories engaged in the manufacture of purely electrical machinery was only 26; the power used in these factories, 769 horse-power; and the total number of operatives employed, 756. The national government operates factories which build some electrical apparatus, but their output is no particular factor in the industry in general. The beginning of the real expansion dates from the close of the Russo-Japanese war when the nationalization of all steam railroads was finally decided upon. Then a large portion of the available capital, which had hitherto been invested in steam roads, began to be directed toward the electrical industry, such as hydro-electric power development, electric railways, etc. This brought about a rapid augmentation of electrical manufacturing, and the number and size of factories increased suddenly.

The statistics for the last year are still unavailable, but I learn from an authoritative source that the existing factories are utterly inadequate to meet the demand, which continues to increase at a very rapid rate. As a result, several influential capitalists are contemplating the establishment of large, up-to-date factories. One of these has already been started at Kobé, and another at Nagasaki. Besides these, one of the largest corporations in this country has decided to build one at Kawasaki, midway between Tokio and Yokohama. When all of these factories, including those already in existence, most of which will undoubtedly be enlarged from time to time, are in full blast, the present output will be multiplied many times. Whether this increased production will cut down the imports from foreign countries or not is a question. Now let us turn to a review of the importing trade and see if we cannot answer that question.

Table I.—Importation of Electrical Goods in Yen (Yen Equals 50 Cents in U. S. Money),

Kind of Articles.	1896.	1897.	1898.	1899.	1900.
Generators and motors.	14,000	168,000	91,000	13,000	309,000
Cables, wires, etc....	1,626,000	937,000	594,000	1,011,000	2,349,000
Elec. cars and carriages.	.....	.....	.....	.....	.....
Total.....	1,640,000	1,105,000	685,000	1,024,000	2,658,000

Kind of Articles.	1901.	1902.	1903.	1904.	1905.
Generators and motors	389,000	811,000	837,000	1,266,000	2,455,000
Cables, wires, etc....	1,483,000	885,000	1,065,000	2,082,000	3,775,000
Elec. cars and carriages	.....	28,000	135,000	906,000	531,000
Total.....	1,872,000	1,724,000	2,037,000	3,254,000	6,761,000

The imports of electrical machinery were insignificant up to very recently, being confined principally to telegraphic apparatus. The importations went up suddenly at the close of the Japanese-Chinese war, and for the first time a separate heading for electric dynamos and motors appeared in the custom house returns for 1896. Table I shows the amount of imported electrical goods from 1896 to 1905; 1896 and 1897 were the years in which an abnormal expansion of all industries took place, but a financial depression followed, as some financiers had predicted. In 1900, business returned to normal conditions. From this time on the increase of imports has been steady. The tables of imports for the years 1906 and 1907 at hand do not contain a separate entry for electrical goods, this item being included under the heads of machines, and bars, rods, wires, etc. Since the total amount of machinery imported in 1906 and 1907 was 90 per cent and 187 per cent of that of 1905, the amount of electrical goods would have been 6,080,000 and 12,600,000 yen in the corresponding year if the same ratio of the latter to the aggregate amounts held. It is certain that the ratio was more largely in favor of electrical goods owing to the fact that the nationalization of all steam railroads was approved by the Parliament in 1906, the effect of which has been briefly stated in this article.

Now let us see to what extent American manufacturers benefited from this situation. Table II shows the motors and generators imported from various countries. As will be seen, the Americans supplied the largest portion. Next comes Great Britain, closely followed by Germany. Germany is at the head in the importation of telegraphic wires and apparatus, Great Britain in submarine and underground cables, and the United States in electric cars and carriages. The figures for 1906 and 1907 are not yet at hand, but the general indications are that this country is far ahead of others in importations. It is to be noted in this connection that very recently several German firms have been vigorously pushing their way and it is not unlikely that Great Britain may fall behind Germany. The American manufacturers, too, may lose some of their customers unless they guard their interests with great care.

Table II.—Importation of Generators and Motors in Yen (Yen Equals 50 Cents in U. S. Money).

Countries	1900.	1901.	1902.	1903.	1904.	1905.
United States....	195,000	231,000	682,000	524,000	872,000	1,860,000
Great Britain....	97,000	58,000	61,000	185,000	228,000	423,000
Germany	15,000	58,000	65,000	119,000	222,000	168,000
Other countries..	2,000	42,000	3,000	9,000	3,000	5,000
Total.....	309,000	389,000	811,000	837,000	1,265,000	2,456,000

Thus far the history of the importation of electrical goods has been one of rapid expansion. Will this continue even if home manufacturing develops as it has been doing? No doubt there will be sharp competition in certain lines of goods, but it does not seem probable that the imports will be materially affected. On the contrary, present indications point toward rapid increase, at least for a good while to come. Small machines can be built in Japan at a cost which compares favorably with imported apparatus. However, large units cannot be produced even at a much higher cost than foreign machines. Again, the experience of engineers in the past has been that they could not rely on the home-made machines as well as on imported ones. This remark is applicable to all machines. Complaints have been received time and again from the users of Japanese-made engines, lathes, etc., as to their poor performance and unusually frequent need of repairing. Another factor adverse to home manufacturers is the scarcity of capital. As a rule, factories in Japan are not as well equipped as in America and Europe. This is one of the reasons why, in spite of the fact that labor is much cheaper, the Japanese cannot produce very large machines or very good machines at a reasonable cost.

There is thus a good opportunity for American manufacturers to increase their business in a market which promises to become of more importance each year. How to accomplish the extension of this business is a matter of personal opinion and judgment. The erection of factories in Japan by Americans, as is being done by one of the companies, seems to be a very wise measure. The advantages resulting from this plan are many, such as nearness to the market, utilization of cheaper labor, exemption from the tariff duty, etc. (The Japanese tariff duty on finished machines is 25 per cent ad valorem.) At any rate, the matter of the Eastern market is worth serious consideration, because success in Japan practically means success in other Oriental countries as well.

United States Patent Court of Appeals.

The Committee on Patents of the House of Representatives, Washington, has reported favorably a bill to establish a single court of final appeal in patent cases, which court would have cognizance of cases now coming before the various United States Circuit Courts of Appeals, nine in number. The bill will be considered by the Judiciary Committee before final report to the House.

Of the five members of the court, only the presiding justice would be permanently attached thereto. The other members would be assigned for fixed periods and selected from the bench of United States Circuit or District Court judges, the choice being thus among about 100 judges in this service.

At the hearings in favor of the bill, Mr. F. P. Fish strongly favored the measure reported. Mr. T. J. Johnston favored a permanent court and argued against the provision whereby four of the five judges would be detailed from other United States Courts, which he held to be unconstitutional. Chairman Currier, in sustaining the provision requiring four of the judges to be detailed by the Chief Justice of the Supreme Court from other United States Courts, referred to the struggle that would ensue for the appointment of members of a permanent court, and the difficulty the President would meet with in making the selections.

Final Arrangements for the N. E. L. A. Exhibition.

On April 16 the Exhibition Committee of the National Electric Light Association, consisting of Mr. W. W. Freeman, Mr. Frank H. Gale, Mr. Walter Neumuller, Mr. Rodman Gilder, Mr. Benjamin Wall and Mr. C. P. Frey held a final meeting to arrange the last details for the exhibition at Chicago. The final assignments of space to exhibitors was decided upon. There are only four sections as yet untaken, and there are 22 applications from prospective exhibitors on file. It is planned to open the exhibition on Monday evening, May 18, at 8 o'clock. Invitations will be sent to Class A and B (company and professional) members for a private view between 8 and 9 o'clock. The general reception of the convention will take place at 9 o'clock in the Gold Room of the Annex. Contracts have been closed for the construction of the booths and wiring. The next meeting of the committee will be held in Chicago. Following is a list of exhibitors:

Pittsburg Transformer Company, Pittsburg, Pa.; Electric Service Supplies Company, Chicago, Ill.; Dossert & Company, 242 West Forty-first Street, New York, N. Y.; The Duncan Electric Manufacturing Company, Lafayette, Ind.; The Triumph Electric Company, Cincinnati, Ohio; G. M. Gest, 277 Broadway, New York, N. Y.; Philadelphia Electric Manufacturing Company, 1228 North Thirty-first Street, Philadelphia, Pa.; Fort Wayne Electric Works, Fort Wayne, Ind.; H. W. Johns-Manville Company, 100 William Street, New York, N. Y.; Wm. D. McJunkin Advertising Agency, 167 Dearborn Street, Chicago, Ill.; Sangamo Electric Company, Springfield, Ill.; Electric Appliance Company, Chicago, Ill.; Minerallac Company, 839 Monadnock Block, Chicago, Ill.; ELECTRICAL WORLD, 239 West Thirty-ninth Street, New York, N. Y.; Wagner Electric Manufacturing Company, 6400 Plymouth Avenue, St. Louis, Mo.; Pettingell-Andrews Company, Boston, Mass.; *Electrical Review*, 13-21 Park Row, New York, N. Y.; National Electric Lamp Association, 4411 Hough Avenue, N. E., Cleveland, Ohio; Crocker-Wheeler Company, Ampere, N. J.; General Electric Company, Schenectady, N. Y.; Westinghouse Electric & Manufacturing Company; *The Illuminating Engineer*, 12 West Fortieth Street, New York, N. Y.; *Western Electrician*, 507 Marquette Building, Chicago, Ill.; *Electrical Record*, 123 Liberty Street, New York, N. Y.; C. W. Lee Company, West Street Building, New York, N. Y.; Allis-Chalmers Company, Milwaukee, Wis.; Simplex Electric Heating Company, Cambridge, Mass.; Western Electric Company, Hawthorne, Ill.

Thursday, May 21, will be Commencement Day at the National Electric Light Association's Convention in Chicago, next month.

Mr. Geo. W. Williams and Mr. Frank B. Rae are joint editors of what will be an interesting feature of that particular part of the convention, namely, an illustrated talk on the methods of creating demand for electricity. This will include stereopticon views showing in detail the progress of the outline and sign lighting in large and small cities.

Mr. Percy Ingalls, who has been engaged in the publicity and public policy work of the Public Service Corporation of New Jersey for a number of years, has been secured as editor of the paper on "Publicity" for the Commercial Day program. This subject is divided in two parts: (a) Methods to create public sentiment. (b) Dormant publicity opportunities of lighting companies. Several assistant editors, all in close touch with this particular work, have been appointed to assist Mr. Ingalls in gathering data on this subject.

Changes in Engineering Curricula of Columbia University.

In 1907 Columbia University revised the entrance examination requirements for its Schools of Mines, Engineering and Chemistry by simplifying them and co-ordinating them with the programs of the best secondary schools. By the adoption at the same time of a uniform program of studies for the first year in all courses, students were no longer compelled to make up their minds at the outset as to the particular course they desired to take, and it became much easier for college graduates to enter the schools with adequate credit for advanced standing. Following these steps have come the co-ordination and revision of the three subsequent years of each of the courses. This revision, which has been the subject of consideration by the committee on program of studies and by the officers of instruction concerned, has just been formally adopted by the faculty at its March meeting and will go into effect on July 1, 1908, and it is believed that the result will be to strengthen very considerably the work of the schools.

In the first place, the programs have been thoroughly co-ordinated by cutting out such duplication of instruction as has grown up in the development of the several departments, and courses whose value has been lessened by changes in actual professional methods have been replaced by subjects of greater value to the professional students of to-day. Throughout, the inter-relations of lecture and recitation work with practical work in the laboratory have been carefully considered.

Secondly, the work in many subjects has been made more intensive, and as a result it has been possible to reduce the total number of attendance hours in such courses. For example, calculus is to receive five hours weekly during the first half-year instead of three hours during the year, and the same change is to be made in the important courses of analytical mechanics and resistance of materials. These three fundamental courses must be taken by all professional students. A somewhat similar change has been made in the geological and mineralogical courses, which form an important part of the work in mining engineering and in other courses.

Thirdly, the free time created by this work of excision and condensation will make possible the introduction of important new material. For example, new courses in gas-power and steam-power machinery, and in alternating-current laboratory practice have been introduced in the third-year course in mining engineering. This work has also been introduced into the course in metallurgy, and, in addition, work in mining law and in hydraulics.

Courses in excavation and tunneling, in dynamo and motor practice, and in electrical distribution are added to the course in civil engineering, and the theoretical work in geodesy is moved from the fourth to the third year.

The program in electrical engineering will contain courses on steam turbines and machine design in the fourth year, and a new three-hour course in economics in the third year. The course in mechanical engineering will have additional work in machine design, in the design of manufacturing plants, in metallurgy, in shop organization and works management, and the courses will be further broadened by instruction in industrial law and economics. In the fourth year of the course in chemical engineering provision is made for additional work in electrical and mechanical engineering by the transfer of certain courses previously offered in that year to the second and third years.

The results of the change in entrance requirements and the uniform first year have been most satisfactory to the schools, the total of new students in 1907-08 being 239, as against 162 in 1906-07, a gain of 47½ per cent, and the number of entrance conditions carried by students being reduced 62 per cent, and the number of term conditions 43 per cent. It is expected that the new programs in the professional courses, together with the close personal contact which is now being maintained by the dean and the professors with all the students in the schools, will still further enhance the reputation of the historic "Columbia School of Mines."

CURRENT NEWS AND NOTES.

BREAKAGE OF TUNGSTEN LAMPS.—One of the objections urged against the tungsten lamp is the breakage to which it is subject in shipment. The General Electric Company reports, however, that it has shipped over 75,000 tungsten lamps to all parts of the country and that the breakage in shipment has been below 1½ per cent.

NEW YORK HOME SHOW.—Electrical exhibits will comprise one of the features of the Home Show which is to be held at the Grand Central Palace from May 2 to May 9 (inclusive). A large part of the floor space at the Palace will be given over to the exploitation of electrical necessities and conveniences for all parts of the house.

ALASKA CABLE.—Considerable trouble is being caused to the Alaska telegraph cable by earthquakes and volcanic disturbances. The cable steamer *Burnside* has recently discovered two breaks north of Sitka, within a few miles of each other. The damage to the cable between Valdez and Sitka is greater than was at first supposed. A new and active volcano is reported in the vicinity of Valdez. In repairing some of the breaks near Valdez the ends of the cable were found to be buried deep in the volcanic overflow.

SCENIC NIAGARA.—The Niagara Scenic Commission has reported to the Secretary of War that the Niagara, Lockport & Ontario Power Company should be made to restore the beauty of the river bank at the point where its transmission cables cross the Niagara gorge. The point is about four miles from the falls, and the trees and shrubs were cut, broken and injured by the work necessary in the erection of the towers and lines. The scar left on the face of the cliff is not so bad on the New York as on the Canadian side, where the scenic commission has no authority, but the commissioners of Victoria Park may cause the restoration of the bank on that side.

TROUBLE IN BROOKLYN POLYTECHNIC.—A meeting of alumni of the Brooklyn Polytechnic was held last week to protest against what has been charged as mismanagement of the institute. Since 1899, when Henry Sanger Snow, the missing ex-treasurer of the New York & New Jersey Telephone Company, became president and radical changes were introduced, some alumni say that the school has run up a deficit of $268,989, while before it had been self-sustaining. The borrowing capacity of the institution has now been reached, as its indebtedness is $400,000. Abandonment of the arts course, first suggested by Snow, is particularly opposed by the alumni.

DISCOVERY OF HIGH-FREQUENCY CURRENTS.—In publishing in the *Archives d'Electricite Medicale* a French translation of an article on "The Wave Current and High-Frequency Currents," by Dr. William J. Morton, Dr. H. Bordier, editor of the *Archives*, says in a footnote: "This interesting memoir proves clearly the priority of the work and publications of Dr. W. J. Morton relating to currents of high frequency; it is certain that with his arrangement of 1881 he produced high-frequency currents, employing a static machine in place of the induction coil, as was later employed by E. Thomson, Tesla and D'Arsonval."

NEW ELECTRICAL JOURNALS.—Two new monthly electrical journals, both bearing the name *Popular Electricity*, have appeared, the first number of each being dated May. One of the journals is issued from Chicago, and the other from New York. The Chicago journal announces that its mission is to present the wonders of electricity in plain English, and its New York competitor states that the almost infinite variety of wonders which electricity has wrought will in its columns be explained in attractive, comprehensible terms, yet without sacrificing scientific truth and accuracy. Announcement is also made of the early publication of a third popular electrical monthly, to be called *Electro-technics*.

ENGINEERS AND THE PUBLIC.—In an address before a meeting held April 14 under the auspices of the American Society of Mechanical Engineers to discuss the subject of "Conservation of Our Natural Resources," Mr. John W. Lieb called attention to the fact that the first President of the United States was an engineer who was interested in the development of waterways. The concluding address, by Dr. Henry S. Pritchett, president of the Carnegie Foundation, treated of the attitude of the engineer toward the public. Engineering, he said, has grown into a profession that must consider public interests. The practical demonstration of professional ideals lies in the use of fair judgment, a sound sense of justice and quick appreciation of the larger public causes. The engineer not only plans but carries out great enterprises. If he be a true member of his profession, he will, while serving loyally his employer, keep in mind the honor of his profession, the debt he owes to it and the service to the larger interests of humanity.

NEBRASKA ELECTRICAL ASSOCIATION.—At the annual meeting, to be held May 6 and 7, at Omaha, of the Nebraska Electrical Association, the following papers will be presented: "Duties of the Electrical Inspector," by Mr. Waldemar Nichaelsen, city electrician, of Omaha; "Electric Law," by Hon. W. R. Patrick, state senator from Douglas County; "Electric Rates," by Mr. Homer Honeywell, Lincoln Gas & Electric Light Company, which will be discussed by Mr. I. B. Zimman, of the Omaha Electric Light & Power Company; "The Motor Problem from the Standpoint of Small Central Stations," by Mr. V. W. Bergenthal, Wagner Electric Company; "How to Meet Gas and Gasoline Competition in Stores," by Mr. J. R. Cravath, of Chicago. One of the features of the convention will be the Question Box. A large number of questions submitted for discussion have been distributed among the membership and it is expected that this plan will result in much better contributions on the various subjects than is usually the case. Mr. L. E. Watson, of Beatrice, Neb., is chairman of the program committee.

ELECTRIC SIGNALS FOR STEAM LOCOMOTIVE CABS.—The North-Eastern Railroad of England has equipped its express locomotives and about 14 miles of its main line with electrical apparatus for conveying track signals to the cabs of the engines. In the cab is a dial showing a small semaphore arm by which the conditions of line signals are given. Two pointers indicate the route. A bell in the cab directs the attention of the engineer to the indications when made, so that the system is both visual and audible. Connection is made with metallic bars fitted between and parallel with the rails by a metallic brush carried on the engine. The bars are insulated by ordinary telegraph insulators of porcelain. The first bar with which the brushes come in contact causes the bell to ring in the cab. A hundred yards further on a second bar is encountered which sets the semaphore. This signal may be reversed when the engine passes over similar bars farther down the track, should this be necessary. The signals received are duplicates of the signals in the signalman's tower and are not intended to displace the semaphores now in use, but to supplement them, especially during foggy and stormy weather.

CANADIAN WIRELESS STATIONS.—According to a report issued by the Canadian government, the Dominion owns 13 Marconi stations on the Gulf and on the Atlantic seaboard. Three of these are what are known as "low-power" stations and cost $5,000 each; the others are known as "high-power" stations and cost $10,000 each. The Marconi Company receives $2,500 and $3,500 per annum, respectively, for operating them, retaining all of the tolls.

BUFFALO SIGN ORDINANCE.—The Board of Aldermen of Buffalo, N. Y., have passed an ordinance providing that no electric signs shall be hung in the city without a permit from the Common Council, and that a property owner using an electric sign shall put up a bond of $2,500 to the city. Each electrical lighting company putting up signs must file a blanket bond of $25,000 with the city to protect the city against loss and suit and as a guarantee against damage that may be inflicted to property or persons by an electric sign.

ELECTRICAL IMPROVEMENTS IN GERMANY.—The city of Frankfort, Germany, according to the report of Consul General Richard Guenther, will spend $12,400,000 in various improvements, a large number of which are electrical. The municipal executive board has presented a plan which includes the enlargement of the city's electric plant, the building of additional tramway lines and an electric testing station. The city of Wiesbaden has received permission to issue a loan of $5,500,000 to be expended in part in the construction of electric tramway lines and the extension of the municipal gas, water and electric works.

SIR THOMAS LIPTON AND ELECTRIC LIGHTING.—Sir Thomas Lipton is the latest addition to the 70,000 customers of the New York Edison Company. His several New York offices, which handle his tea business in America, will be gathered under one roof in a seven-story building at the corner of Hudson and Franklin Streets, which, after May 1, will be the central American office of the Lipton Tea Company. The electrical installation, including lighting, will have a rating of from 80 to 100 kilowatts. A large roof sign will be erected, and other spaces suitable for the erection of electric signs in the vicinity of New York City are being considered, including a sign in the harbor, if the authorities will permit it.

TENTATIVE ACCOUNTING SYSTEM.—A circular of 158 pages, embodying a tentative system of accounts for electrical and gas corporations, has been issued by the Public Service Commission of the Second District, the author being Mr. W. J. Myers, statistician of that body. The statisticians of the First and Second Districts have under consideration two tentative systems preparatory to submitting to their respective commissions a system of accounts for adoption. The circular is issued with the request that the gas and electric corporations within the jurisdiction of the commission express their opinions as to the adequacy and appropriateness of the scheme of accounts proposed, and that criticisms and suggestions be made in writing to the commission before April 25.

INDUSTRIAL EDUCATION.—The National Society for the Promotion of Industrial Education has decided to organize State associations. At the meeting of the Board of Managers, recently held in New York City, plans were perfected for establishing these branch societies in 38 States. This testifies to the rapid growth of the society, which held its first annual meeting in January of this year at Chicago. The society has established permanent headquarters at 546 Fifth Avenue, New York City. The society will be represented at the International Congress on Art Education, which is to meet in London next August, by its secretary, Dr. James P. Haney. A committee, of which Dr. Henry S. Pritchett is chairman, will, after a thorough study of the subject, recommend to a municipality a model type of trade school of a kind that will be equal to the industry which the particular city desires to promote.

LIFE OF TANTALUM LAMPS.—Bulletin No. 19, of the University of Illinois, is devoted to an account of comparative tests by Mr. T. H. Amrine, of carbon, graphitized carbon and tantalum filament lamps. The lamps were tested under both favorable and unfavorable conditions, in the first case being connected to a storage battery circuit, and in the second case supplied from a badly fluctuating alternating current. On the basis of an average life to 80 per cent of the original candle-power, the life in hours under the favorable conditions was 400 hours for the carbon filament, 780 hours for the graphitized carbon filament, and 820 hours for the tantalum filament; with the alternating current, the figures became 225, 350 and 350 respectively. With the widely fluctuating alternating current, the tantalum lamps thus made a better showing than the carbon filament lamp.

GAS AND ELECTRIC COMPANIES CONFER WITH PUBLIC SERVICE COMMISSIONER.—The hearing in the matter of the investigation now being held by the Public Service Commission of certain gas and electric companies in New York, scheduled for April 15, took the form of an informal conference between Commissioner Maltbie and the representatives of the various electric and gas companies. The specific subject discussed was that of contracts. At the close of the meeting the Commissioner asked the representatives present to confer among themselves at some future time and endeavor to decide upon some simplified form of contract blank which might be used by all the lighting companies, or else to settle upon a common form of application blank in place of contract blanks. Pending the report to the Commissioner of the various companies no further hearings will be held.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS will hold its annual meeting in Detroit, Mich., June 23-26. Among the papers to be presented at this session are: "A Method of Cleaning Gas Conduits," by W. D. Mount; "A Method of Checking Conical Pistons for Stress," by Prof. George H. Shepard; "Clutches, with Special Reference to Automobile Clutches," by H. Souther; "Horse-Power, Friction Losses, and Efficiencies of Gas and Oil Engines," by Prof. L. S. Marks; "Some Pitot Tube Studies," by Prof. W. D. Gregory; "The Thermal Properties of Superheated Steam," by Prof. R. C. H. Heck; "A Journal Friction Measuring Mechine," by Henry Hess; "A By-Product Coke Oven," by W. H. Blauvelt; "Tests of Some High-Speed Steam Engines," by F. W. Dean. There will be a symposium upon machinery for conveying materials, with papers by several authorities. The Society for the Promotion of Engineering Education, and the Society of Automobile Engineers will also hold their annual meeting in Detroit at this time, which will enable members of each society to participate in the sessions of the other.

MUNICIPAL OWNERSHIP IN NEW YORK CITY.—Comptroller Metz, of New York City, has refused to sanction a plan for isolated electric-lighting plans for the new buildings of the New York Public Library and Bellevue Hospital. He showed that the cost of furnishing lighting by the isolated plant in the American Museum of Natural History was 16 cents per kw-hour; the plant was abandoned and the New York Edison Company is furnishing current at 3½ cents per kw-hour. Commenting on municipal ownership, he said that a private company can get better results than can be obtained from a municipal plant. "It is not bound down by any such restrictions as the eight-hour law; the officials of the company see to it that there is no waste or loafing; because it is a commercial project there is more efficiency and as a result any of the lighting companies of this city can sell us light cheaper than we can make it. There is proof in my own office here that it costs the city more to do its business than if it were a private concern. If the finance department was a commercial house, as it really ought to be, and was under the system which prevails in large financial houses, the department would cost the city just about half of what it costs now."

LORD RAYLEIGH has been elected chancellor of the University of Cambridge, succeeding the late Duke of Devonshire.

MICHIGAN ELECTRIC ASSOCIATION CONVENTION.—The convention of the Michigan Electric Association is to be held at Grand Rapids Aug. 18, 19, 20 and 21. Mr. A. C. Marshall, of Port Huron, is secretary.

CARBON-FILAMENT LAMP EFFICIENCY.—In a report on the municipal lighting plant of Tacoma, made by Mr. F. G. Simpson, it is stated that of 363 carbon-incandescent lamps tested, all but eight showed a consumption which varied from 4.8 to 5.5 watts per rated candle-power, and in some instances the consumption approached 15 watts per actual candle-power.

INTERBOROUGH RAILWAY COMPANY CAN SELL POWER.—By a decision of the upper branch of the New York State Supreme Court, the Interborough Rapid Transit Company, of New York City, has a right to sell its surplus power, even though conveyed through ducts owned by the city. This decision overrules that of a lower court against the railway.

JAPANESE POWER PLANT.—Mr. James D. Schuyler, hydraulic engineer, of Los Angeles, Cal., has been appointed member of a board of engineers to investigate and report on a power plant in Japan for an English syndicate to operate the street railways in Tokio and Yokohama, and to furnish current for lighting and power of those cities. The first installation will cost about $5,000,000.

THE TELEPHONE IN SWITZERLAND.—In Switzerland the telephone service is operated by the government, the total length of lines being 10,548 miles. The annual rental charges for offices, business houses and residences is $12.45 per year, with an additional charge of 1 cent for each local connection. For interurban or long-distance calls the additional rate is 2 to 14 cents for three minutes, the latter figure being the maximum rate for any distance in the country. The revenue last year was $668,702 for rentals and $829,732 for calls. The total number of subscribers was 53,711.

TOLEDO A. I. E. E. BRANCH.—At the April meeting of the Toledo branch of the American Institute of Electrical Engineers Mr. T. R. Fishback, of the Electric Controller & Supply Company, of Cleveland, read a paper on lifting magnets and their application. He explained the development of the plate-lifting magnet as well as the more recent application of the scrap-lifting or concave-bottom magnet. A number of views were shown of the actual operation of magnets in lifting heavy plates or large billets of metal. The paper elicited quite a discussion on the part of the members of the local organization.

REJUVENATED SONS OF JOVE.—In the Buffalo *Commercial* of Tuesday, April 7, a full page is occupied by an account of the Rejuvenated Sons of Jove, the object of the organization and the result of some of its work. The national body is divided into districts, of which the western New York district, comprising all the territory west of Rochester, is one, under the jurisdiction of Mr. James B. Eaton, of the Rochester Railway & Light Company as Jovian Statesman, and Mr. Wm. E. Robertson, of Buffalo, as Jupiter. There are about 80 members of the order in Buffalo, including manufacturers and jobbers of electrical apparatus, electrical contractors and engineers in large industries using electrical power.

NIAGARA POWER IN ONTARIO.—In a recent debate before the Ontario Legislature the government made official announcement of the fact that the Hydro-Electric Power Commission would be able to secure electrical energy from Niagara Falls at a figure as low as $9 per hp-year instead of $10 as was provided under the original contract with the Ontario Power Company. By the terms of the contract, the government can satisfy demands for any quantity from 8000 to 100,000 horsepower at rates ranging from $9 to $9.40 per hp-year, according to the quantity taken. It appears, however, that the municipalities purchasing power must pay in addition interest on the cost of the transmission line, cost of its maintenance, repair, etc., and must pay 75 per cent of the power contracted for, and also on the basis of monthly bills fixed by the greatest quantity of energy taken for any 20 minutes thereof.

A SAFE ROENTGEN-RAY TUBE.—Prof. Albert C. Geyser, of Cornell University, announces that he has perfected a Roentgen-ray tube in the use of which there is no danger of serious X-ray burns. In the experiments which resulted in the tube, Dr. Geyser is stated to have experienced some painful burns which have disfigured his hands, the injuries almost necessitating amputation. The tube is made of a heavy lead glass so that no rays are emitted, except through a flint glass window, which corresponds in size to the lesion to be treated. The connecting wires are encased in glass insulators to prevent sparking on any part of the patient while under treatment. The flint glass window is situated at the end of a projection and must be in direct contact with the lesion, thus furnishing a ground and doing away with the air space which, it is stated, "would otherwise be a dielectric between the tube and the patient. When a tube is brought into direct contact with the patient only the ionizing effect of the X-ray is exerted on the tissues, and this effect is all that is needed to furnish the most brilliant therapeutic results."

LOW-VOLTAGE TUNGSTEN LAMPS.—In referring to some tests made by it on small candle-power, low-voltage tungsten lamps, our London contemporary, *Electricity*, points out their suitability to storage-battery installations on account of the comparatively little change in the light as the battery nears its discharge point. In the experiments made, the candle-power was maintained up to the last half-hour of battery discharge. Another point noted in connection with the miniature low-voltage lamps tested was the rapid blackening of the globes which occurs just before rupture of the filament. "This appears to be the definite signal of approaching dissolution, and takes place very rapidly until, when the lamp's useful life comes to an end, the globe is very badly 'smoked.' I have a 4-cp Osram bulb on my desk which presents the appearance of having been held over a smoky flame. It would be interesting to learn the explanation of this rapid blackening of the globe; presumably the filament gradually disintegrates, until, toward the last, a species of subdued combustion goes on, followed by deposition of the oxidized products upon the interior surface of the globe."

POWER DEVELOPMENT IN KLAMATH COUNTY, CALIFORNIA.—Three hydro-electric power plants are now in course of construction in Klamath County, California. The largest is what is known as the Southern Pacific plant at Spencer Creek, which is said to be the largest ever contemplated by that company, and which will take three years to construct. The next in importance is the government plant to be built on Link River, in conjunction with the Keno Canal. It will have a capacity of 1600 horse-power, and will furnish power for all the pumping stations in various parts of the Klamath project. These pumping stations will provide irrigation for the higher lands above the present system of laterals. The cut-off from the Keno Canal is now being made to prevent breaking-in on the completed canal later. The plant will not be pushed this year, as the power will not be needed until more work is done on the project. Moore's power plant is a short distance down the river from the government site, and will be completed this year, and will furnish light and power to the two valley towns of Bonanza and Merrill. Pole lines are nearly constructed to both points. These three plants are stated to represent the utilization of a very small amount of power lying dormant in Klamath County.

Generating and Distributing System of the Portland (Ore.) Railway, Light & Power Company.—III.

SUBSTATION "A."

THIS substation is located in the heart of the business district of Portland, at the corner of Seventh and Alder Streets. The building is a one-story brick structure with basement, occupying a plot 100 x 100 ft., which is divided into two portions, the main station room being 60 x 100 ft. and the high-tension compartments and arc room occupying the remaining 40 x 100 ft. The main operating room is provided with a 20-ton, hand-operated traveling crane. High-tension current at 10,000 volts is transmitted to this substation and here transformed to meet the needs of the lighting and railway systems.

In this substation are installed three 1000-kw rotary-converters, each provided with three, 367-kw air-cooled transformers. The rotaries are located on a substantial concrete foundation extending the full length of the building, and are started on the alternating side, 1/3 and 2/3 taps on the transformers being used for this purpose. A 10,000-volt, three-pole, oil switch with trip is placed between the 10,000-volt busses and the transformers. The direct-current sides of the rotaries are all connected in parallel on one railway bus and suitable feeder panels are located on the operating floor to control the various railway circuits.

A blower system consisting of a 100 and a 90-in. motor-driven blower is located in the basement of the building, the air being conducted to the transformers by suitable galvanized-iron tubes. This blower system takes fresh air from a shaft in the rear of the station, which leads to the roof of the building, thereby insuring clean, fresh air for the transformers.

Inasmuch as the frequency of the high-tension system is 33 1/3 cycles it is necessary to use frequency-changers in order to secure 60-cycle current for lighting and motor service about the city. The equipment at this substation for making this necessary transformation consists of five 1000-kw frequency-changer sets; one 500-kw frequency-changer set, and one 80-kw starting motor generating set.

The larger frequency changer sets are made up of one 1040-kw, 33-cycle, three-phase, 10,000-volt synchronous motor, direct connected to a 1000-kw, 60-cycle, three-phase, 2300-volt, alternating-current generator. On a shaft extension of this machine is located a 60-kw, 120-volt, direct-current combined starter and exciter. The smaller sets are made up of one 500-kw, 33-cycle, three-phase, 10,000-volt synchronous motor, direct connected to a 520-kw, 60-cycle, three-phase, 2300-volt, alternating-current generator. On a shaft extension is a 50-kw, 120-volt, direct-current combined starter and exciter. These machines take energy from the 10,000-volt bus through three-pole automatic, hand-operated, oil switches. The 80-kw starting set consists of an induction-motor, direct connected to a 120-volt generator. A 100-kw. oil-cooled transformer is used in connection with this set, stepping down the potential from 10,000 to 240 volts. The combined starters and exciters used on these sets are compound wound.

These sets change the frequency from 33 cycles to 60 cycles, the motor being a 10-pole machine while the generator is provided with 18 poles. Two Lincoln synchronizers, one for the generator and the other for the motor, are placed on the

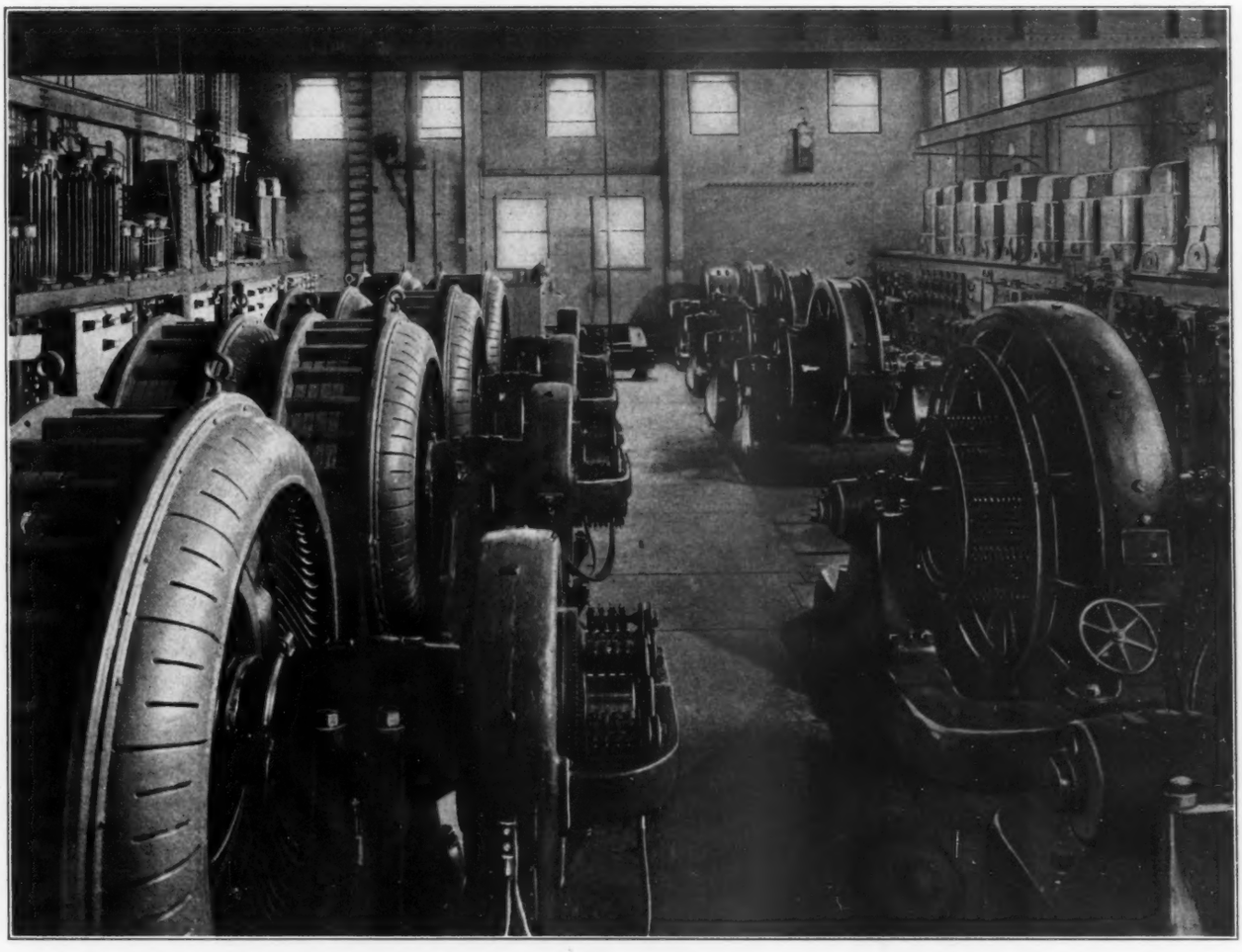


FIG. 1.—INTERIOR VIEW OF SUBSTATION "A," PORTLAND RAILWAY, LIGHT & POWER COMPANY.

switchboard. In order to facilitate the synchronizing of the two machines, double-pole, double-throw, field switches have recently been placed on the panels.

All of the lighting panels feeding from the 2300-volt busses are three-phase, the lighting load being fed from one phase, and the third wire is installed whenever necessary to install small motors. A three-phase motor panel is used to feed all of the heavier motors. Tirrill regulators are used in connection with these sets.

The high-tension switch room is located in the rear of the 40-ft. portion of the building. At this point there are six 10,000-volt General Electric motor-operated, oil switches. These switches control the incoming 10,000-volt feeders from the generating station and tie feeders running to other substations. The remote-control switchboard panels for these switches are located on the main station operating floor.

The arc-lighting system in use at this substation is made up of 10 series mercury-arc rectifiers. Each equipment consists of a 44-kw, constant-current, oil-cooled transformer. These transformers are connected to the 10,000-volt, 33-cycle busses and are equally divided on the three-phases. The control panels are each provided with an operating handle for a triple-pole oil switch. On the panels are also situated the ammeter and necessary plugs for making transfer connections. Each panel is further provided with a starting switch and at the top and slightly in the rear is a small panel upon which are mounted the two mercury-vapor arc rectifier tubes. Auxiliary apparatus consisting of exciting transformer, air ducts for leading air to cool the rectifier tubes, reactances, etc., also form part of the equipment. Two direct-connected blowers supply the proper amount of air for the tubes. Each rectifier set is capable of operating 75 magnetite arc lamps. At the present time there are about 700 such lamps operating from this substation.

SUBSTATION "D" AT ALBINA.

This recently completed substation is in a handsome fireproof, brick building of imposing design; the building has a frontage of 141 ft., a depth of 46 ft., in its main portion, with a wing on one end 62 ft. deep. The height over all is 44 ft., the substation room proper being 34 ft. high and the lower floor 10 ft. high.

The operating room is provided with an abundance of light by means of seven large windows. The lower floor is on the level with the street. Heavy machinery is brought into the building through a large door on this lower floor and can be picked up from the transfer trucks by means of a 20-ton traveling crane.

On the lower floor of the station proper are located all of the 10,000 volt busbar compartments, 10,000-volt lightning arresters, disconnecting switches, potential and series transformers, and the accompanying wiring. In the basement is a brick air-tight vault and two 60-cycle, alternating-current blowers are provided for supplying air to this high-pressure chamber over which are located the transformers for the rotary converters. This floor also contains the motor-driven pumps for circulating the cooling water used in connection with the high-tension transformers. A small storage battery for operating the 10,000-volt, motor-operated, oil switches is also on this floor.

The floor of the operating room is of reinforced-concrete construction formed of 18-inch I-beams spaced at suitable distances to accommodate the machinery. Expanded metal and iron bars form the reinforcement. The roof is made up of heavy steel trusses surmounted by 2-in. tongue and grooved seasoned fir plank toenailed firmly to nailing strips which are fastened to the steel purlins by means of through bolts. A tar and gravel covering forms the finished roof. On the roof of the building is located cooling apparatus for the circulating water.

The electrical equipment comprises two six-phase, General Electric, 1000-kw rotary converters together with step-down transformers, operating panels and oil switches. These machines are started in a similar manner to those in substation "a" described before. There are in addition, one 1000-kw frequency changer, together with its panels; one 85-kw induction motor starting set together with its panels; one battery-charging, motor-generating set together with panel; eight General Electric motor-operated oil switches; and 11 mercury arc rectifier panels together with the usual constant-current transformer equipment.

The wing on the east end of the building exceeds the height of the main station by 6 ft. and in this wing are the 33,000-volt lightning arresters and oil switches, disconnecting switches, barriers, etc., which go to make up the high-tension equipment of the station.

On the lower floor of this wing, each in its separate brick fire-proof compartment, are located the nine 33,000/11,000-volt high-tension transformers. These transformers are rated at 850 kw each. Means are provided for observing the flow of the cooling water through the transformers without entering the vaults. All of the high-tension busbar compartments and wings are built up of reinforced concrete, expanded metal being the reinforcement employed. The 30,000-volt lightning arresters are situated between wings on the walls of the high-tension compartment. The 10,000-volt lightning arrester equipment is also mounted between wings, thereby isolating the wires of each phase.

RAILWAY SUBSTATIONS.

Among the minor substations of the Portland Railway Light & Power Company are those which are used entirely for supplying 600-volt, direct-current to the street railway systems. There are five of these stations, equipped as follows:

The Sellwood substation equipment comprises two 400-kw rotary converters, together with direct-current and alternating-current operating panels, feeder panels, etc.; four triple-pole, single-throw, oil switches for subdividing the high-tension feeders which enter and leave this substation; and six oil-insulated, water-cooled transformers, each rated at 150 kilowatts.

The Lents Junction substation equipment consists of two 400-kw rotary converters; six single-phase, 150-kw air-blast transformers, suitable alternating and direct current operating panels, together with triple-pole oil switches; and one blower set for supplying air to transformers.

The Boring substation contains two motor-generator sets consisting of 600-kw synchronous motors, direct connected to a 400-kw Bullock generator, together with suitable switches and panels for operating the same.

The equipment of the Gresham and Eagle Creek substations consists of one 400-kw rotary converter; three single-phase, 150-kw water-cooled transformers, together with proper panels, switches, etc., for operating same.

The St. Johns substation equipment comprises one 400-kw rotary converter; three 150-kw air-blast transformers for the rotary; three 375-kw air-blast transformers for supplying 33-cycle alternating current to several large motors in St. Johns, and one blower equipment for cooling transformers and rotaries.

In addition to the above there are two lighting substations. "The Oaks" substation equipment consists of two 10,000/220-volt, single-phase transformers, one rated at 200-kw and the other rated at 100 kilowatts, which supply enegry at 33 cycles for lighting "The Oaks," which is a large, outdoor amusement park operated by the Portland Railway, Light & Power Company. The Estacada substation contains two 30-kw, air-cooled, 33-cycle transformers. These transformers are used to supply energy for lamps to the town of Estacada. Panels, switches, etc., for controlling the circuits complete the equipment.

It has been the practice of the Portland Railway, Light & Power Company to build substations which are tasteful in design and surrounded by neat appearing grounds. In several cases small homes have been built for the attendants, and at one or two points especially much taste has been displayed in the artistic arrangement of flowers, gardens, shrubbery, etc.

The most important of the above mentioned substations is

that at Sellwood. This is a stone building two stories in height, the upper story containing the oil switches which form the connecting link between the several high-tension lines coming in and going out of the substation. A house for the attendants is located at the rear of the station. The rotaries are on the main floor, as are also the operating panels.

At the rear of the station, and located each in its own fireproof compartment, are six oil-insulated, water-cooled, 150 kw transformers. The water-cooling system for these transformers is so arranged that the attendant on the main operating floor can observe the flow of the water supplied to the transformers. He also has at his disposal valves with which he can regulate the flow. A pump, supply tank, and cooling tank are provided in a separate building at the rear of the station. Water is pumped from a well into the tank and after passing through the transformers is cooled off and used over and over again, the waste being supplied from the well. Connection is also made with the city water system, which is thereby available in the case of accident.

Another typical type of substation is that at Lents Junction. This substation is a brick structure one story in height. A home for the attendants is situated in the same lot in the rear of the substation. The high-tension line from which this substation and several others on the Cazadero interurban line are operated is looped into and out of each of the substations, thus enabling the operator to subdivide the line in the event of trouble at any one point on it. This at times is found to be very convenient, as it allows of the operation of all but possibly one of the substations at such times as there is trouble.

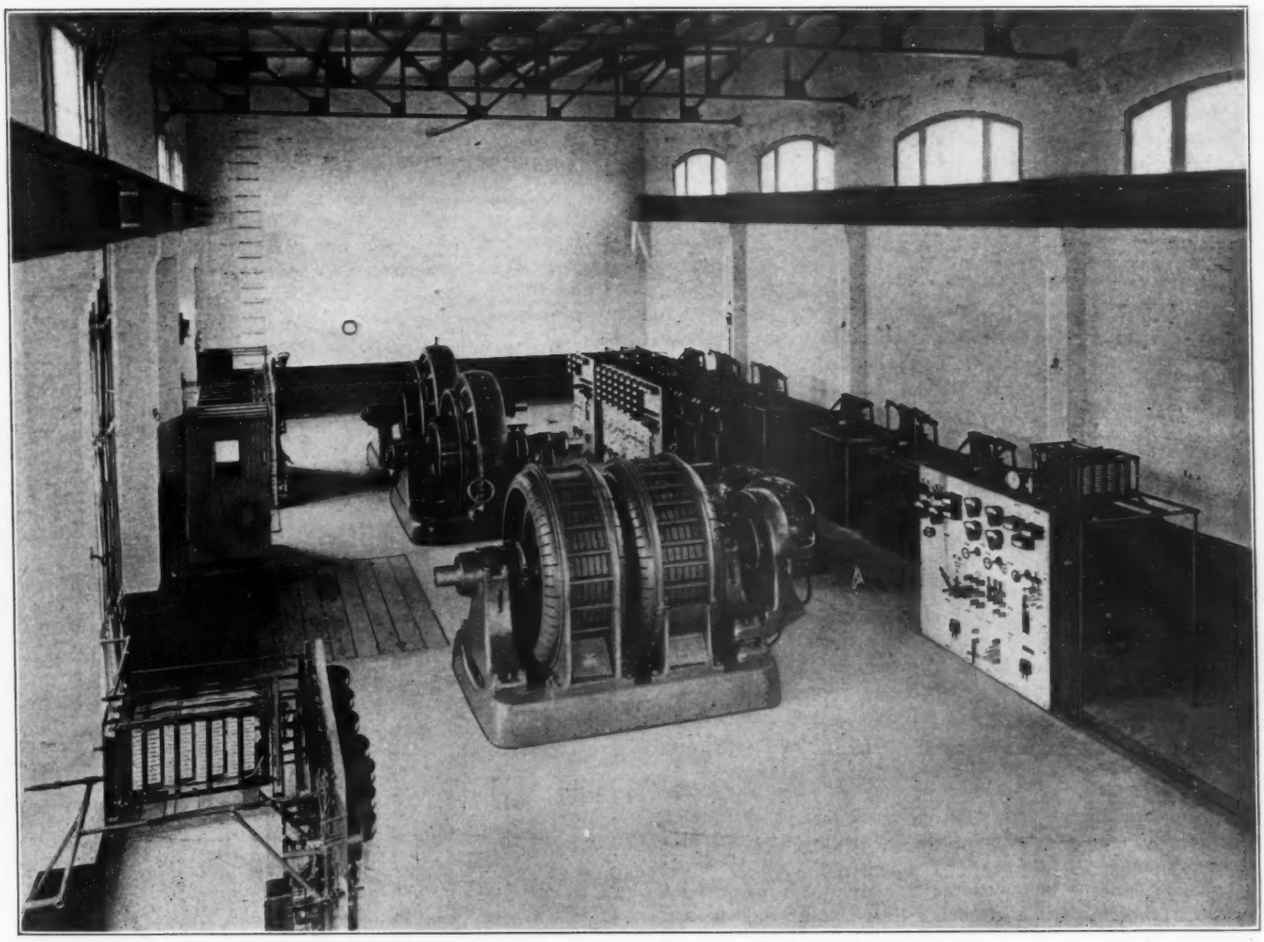


FIG. 2.—INTERIOR VIEW OF SUBSTATION "D," PORTLAND RAILWAY, LIGHT & POWER COMPANY.

OPERATING FEATURES OF THE SYSTEM.

As previously noted, the high-tension system of the Portland Railway, Light & Power Company is composed of three distinct sections: The Lower Willamette Valley System, the Upper Willamette Valley System, and the Vancouver System.

The feeders in the Lower Willamette Valley carry electricity at potentials of 10,000 and 33,000 volts and at a frequency of 33 cycles. The Cazadero station (G), located 30.6 miles from substation "d" in Portland, generates electricity at 10,000 volts, 33 cycles. The potential is then stepped up to 33,000 volts and transmitted directly to substation "d," no taps being taken off either of the duplicate high-tension lines between these two points. At substation "d" the potential is again stepped down to 10,000 volts and fed to the buses which are in multiple with the 10,000 volt, 33-cycle system of Portland.

Station B, at Oregon City, generates electricity at a potential of 10,000 volts and the energy is transmitted at this voltage from that point by duplicate lines directly to substation "a," Portland, and to substation "b" on the east side of the river, proceeding directly from substation "b" to substation "d," and also running out to the Cazadero line of the Oregon Water Power & Railway Company. Station B also furnishes electrical energy for transmission to Salem, a distance of approximately 40 miles, and to the substations of the Oregon Electric Railway Company along the line, the transmission tension being 30,000 volts. Station E likewise generates 33-cycle current at 10,000 volts and transmits energy directly to substation "a."

It will be noticed, that the system of feeders forms a sort of reservoir of energy into which the various generating stations pump and from which the several substations are supplied. Lighting and power feeders are all operated in multiple and the system is tied in completely from station E on the north to station B and the Cazadero station on the south.

By means of numerous tie lines and interconnections of the 10,000-volt system, operating conditions are such as to allow the shutting down of sections of the 10,000-volt feeders at such times as is necessary on account of construction or other work. It is proposed in the near future to run a feeder from substation "c" across the Columbia River to Vancouver, Washington, installing at that point a substation.

The Upper Willamette Valley system derives energy mainly from Station B, Oregon City, although the water-power plant at Silverton is operated during periods when the water is plentiful. A 20,000-volt transmission line, which is over 18 miles long, connects Silverton and Salem, and this line branches off to Woodburn and intervening towns.

The generating station for the Vancouver system is located in the town of Vancouver. The equipment consists of 2300 volts, 60-cycle, two-phase generators, and the system is soon to be tied in with the Portland system.

Mr. F. G. Sykes is the general manager of the light and power department of the Portland Railway, Light & Power Company and to him we are indebted for many courtesies extended in the preparation of these articles. The hydraulic engineer for the company is Mr. T. W. Sullivan. The mechanical and electrical installation is looked after by Mr. O. B. Coldwell and the transmission lines by Mr. H. S. Sladen. These three men comprise the engineering staff of Mr. Sykes' office. W. S. Barstow & Company, of New York, had much to do with the design of all the stations. The officers of the company are as follows: President, Mr. B. S. Josselyn; vice-presidents, Mr. F. I. Fuller and Mr. H. L. Clark; assistant secretary and treasurer, Mr. C. N. Huggins; secretary and assistant treasurer, Mr. G. L. Estabrook. The directors are Messrs. B. S. Josselyn, F. I. Fuller, H. L. Clark, C. N. Huggins, A. C. Bedford, Frederick Strauss, Ogden Mills, Frederick V. Holman, C. M. Clark, F. G. Sykes and Samuel G. Reed.

The Magnetite Arc.

By G. M. Dyott.

In the issue for Dec. 7, 1907, a description was given of the magnetite arc burning under ideal conditions. Such a state of affairs, however, rarely exists in practice, so that care must be exercised in preparing electrodes for commercial purposes, in order that the performance of the lamp may be satisfactory throughout the life of the electrodes.

The development of flame arc carbons has required years of careful investigation to bring them even to their present state of perfection, so that it is only reasonable to expect great improvements in the manufacture of magnetite electrodes also, which, on account of their high efficiency and other excellent qualities, open up great commercial possibilities for the magnetite arc lamp.

The magnetite or luminous arc is more stable on relatively large currents, but for a given arc length and composition of electrode there is a certain current value which it is not advisable to extend. A number of tests were made to ascertain the current most suitable to use with various arc lengths, and to this end a ⅝-in. electrode was prepared, consisting of 60 per cent of Fe_3O_4 (magnetite iron ore), 27 per cent TiO_2 (titanium oxide) and 13 per cent of $FeCr_2O_4$ (chrome iron ore). A large number of readings were taken of the voltage, current and arc length and these were plotted in the form of curves, which are shown in Fig. 1. These curves only apply to an electrode of the composition noted above, used in conjunction with a copper positive electrode, and burning with the negative electrode in the lower holder of the lamp.

In these curves the first point of interest to note is that a drop of approximately 7 volts occurs between the electrodes when they are in actual contact, and that on separating them 1-10 of an inch the potential rises sharply to approximately 35 volts. On further separating the electrodes the voltage rises fairly uniform until a point on the curve is reached, where the voltage once more abruptly rises. This point, which is marked with a cross on each curve, is analogous to the hissing point of the carbon arc and determines the maximum length of flame which it is practicable to use with that particular current. Experience, however, has shown that for commercial work the arc length should, at least, be from 25 to 30 per cent shorter than that indicated by this point.

In order to determine the relations existing between arc length, wattage, etc., another series of curves was plotted, as shown in Fig. 2, giving the power taken by the arc at various

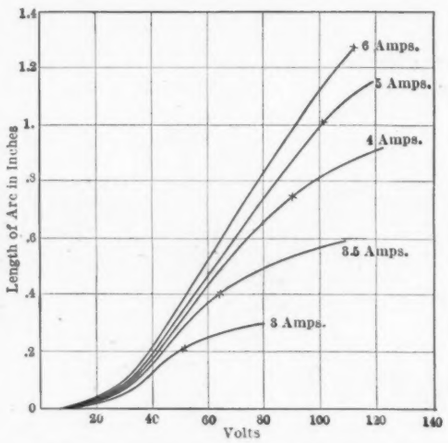


FIG. 1.—RELATIONS OF VOLTAGE, CURRENT AND ARC LENGTH.

currents and arc lengths. From these curves it is evident that if a ¾-in. arc is desired a current of not less than 4 amperes should be used, and preferably 5 or even 6 amperes. When considering these curves it must not be forgotten that the arc is more luminous at the negative end, and the higher the current used the farther away from the negative electrode does this luminous portion extend. In a 6-10-in. arc, for instance, using a current of 3½ amperes, the power consumed is approximately 390 watts, and if 6 amperes were used practically the same power would be required. In the first case it will be noticed that, since this part of the curve lies above the hissing point, the arc would be very unstable. With 6 amperes the arc would not only be very steady, but the total flux of light emitted by it would be almost doubled, due to the extension of

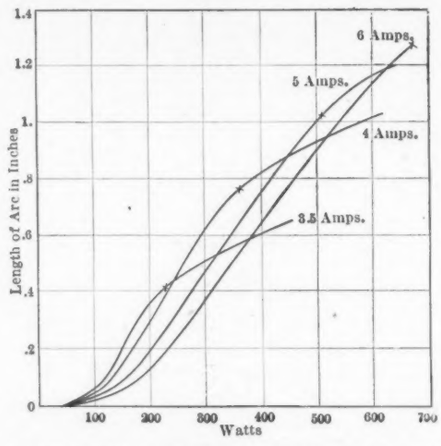


FIG. 2.—RELATIONS BETWEEN ARC LENGTH AND WATTAGE.

the luminous zone over the entire vapor bridge. Fig. 3, which represents a ⅝-in. arc burning with a current of 6 amperes, illustrates this point very clearly, especially when comparison is made with Fig. 4, a photo of the same arc taking only 4 amperes.

Since on low currents this highly luminous area is confined to the lower extremity of the arc and is in close proximity to the pool of the molten slag, from which it issues and which acts as a reflector (see Fig. 5), it has been claimed that more

economical results could be obtained by burning the arc upside down. There is no doubt but what such an arrangement gives an entirely different light distribution curve, in which the maximum intensity of illumination is approximately 80 deg. below the horizontal, but it is questionable whether the total flux of light for the same current and arc length in each case is not considerably less with the inverted arc.

A comparison should be made between Fig. 3 and Fig. 6, showing the two types of arcs, each consuming the same current. The extent of the luminous zone in either case is apparent.

The particular field of illumination for which the magnetite arc is most adapted is series street lighting, and, since for such work the maximum intensity of illumination should be between 25 deg. and the horizontal, and not directly below the lamp, it is doubtful whether the small saving in power consumption of the inverted arc overbalances the better distribution of light obtained by using the negative in the lower holder of the lamp. If the only features of consideration were those involving the mechanical design of the lamp the inverted type would probably show up to better advantage.

Any one who has had experience with the magnetite arc has noticed that at certain periods the arc loses all of its peculiar brilliancy, turning a sickly yellow color. These occurrences last from a few seconds up to several minutes and seriously detract from the striking quality of the light. It has been observed that these yellow streaks occur more frequently toward the latter end of the life of an electrode, and, it was therefore supposed that poor mixing of the ingredients was the cause, but repeated experiments along these lines showed that, while the effect was appreciable, yet it was not entirely responsible for the phenomenon.

It was then supposed that the copper positive electrode might in some way be responsible for it, and a number of tests were therefore made, using positive electrodes of the same dimensions, but made out of different materials, one of iron, one of brass and one of copper. The lower electrode was not changed.

For a period of 100 hours these arcs were burned alongside one another, and the peculiarities of each carefully noted. At the end of this time the following facts were observed: (a) That the arc used with the iron upper electrode gave the most yellow streaks, and that used with the brass electrode gave the least yellow streaks; (b) that the consumption of the iron electrode was ¾ in. per 100 hours, that of the copper 1-16 in. per 100 hours and that of the brass practically nothing; (c) that the iron positive electrode continually took up globules of molten matter from the negative electrode, that the copper positive electrode did so also to a certain extent, but that the brass electrode remained fairly clean.

From these observations the following deductions might be drawn:

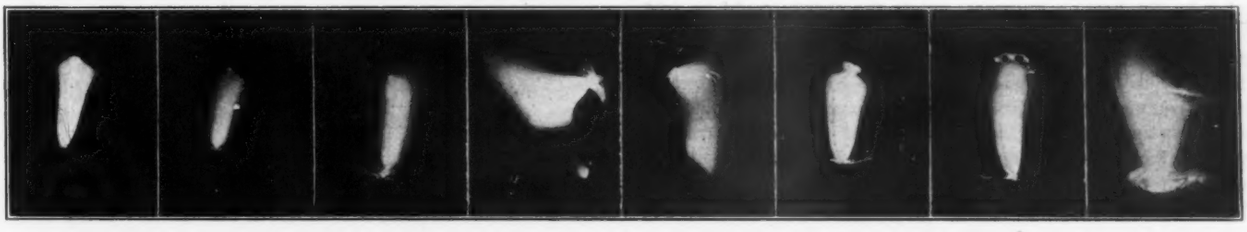
1. That the composition of the upper electrode is not directly responsible for the yellow streaks, otherwise the iron upper electrode would not have given so many, for the oxide of that metal tends to give a bluish-white color to flame; 2. Since the fault is not in the composition of the upper electrode, it must be due to the lower electrode and must be caused by some material in that electrode; 3. It cannot be Fe_3O_4 (magnetite iron ore), for that gives a bluish-white flame; 4. It cannot be TiO_2 (titanium oxide), for that gives a pure white flame; 5. The fault must, therefore, be in the $FeCr_2O_4$ (chrome iron ore). It cannot be entirely due to impurities, for all carbons were the same in each lamp; therefore, it must be due to the material itself.

The solution presumably is as follows: The upper electrode has a globule of molten matter adhering to it. The extreme heat volatilizes the magnetite iron ore readily; the titanium oxide is the next to volatilize and chromium remains behind; hence, the reason why the iron electrode gave the most streaks, more globules adhered to it, and therefore chromium appeared in excess.

It was also found that after a globule had been deposited on the upper electrode and the arc was allowed to play on it for a short time, and then transferred to the lower electrode, a very brilliant and fierce arc ensued, showing an excess of titanium oxide; but if another globule was allowed to stick to the upper electrode for a considerable length of time, and then transferred to the lower electrode a yellow arc was the result, showing that magnetite iron ore and titanium oxide had been consumed, leaving chromium behind.

Spectrum analysis also showed chromium to be present, giving the three characteristic lines in the green. These were predominant during the yellow streaks. This then accounts for the yellow streaks being prevalent after the electrode has burned some time; the chromium is not consumed at the same rate as the other materials and, hence, collects in excess. To avoid these disagreeable yellow streaks it is advisable to use as small an amount of chromium as possible, or, better still, to incorporate certain salts in the electrode, which will act as a flux, preventing the local accumulation of any one ingredient.

In the foregoing tests it appears that a brass positive electrode keeps considerably cleaner than does a copper electrode, and the writer, therefore, advocates the use of certain grades of this material, since the condition of the upper electrode has some bearing on the behavior of the arc. It is, of course, known that on reversing the direction of the current through the lamp the arc undergoes a remarkable change, clearly shown in Fig. 7. Not only does the flame lose in brilliancy, but that part of it adjacent to the anode gives practically no light at all. This being the case, if under ordinary conditions a globule of slag adheres to the positive electrode, and the arc plays upon it, the luminosity of the upper part of the flame diminishes in intensity. This condition is shown in Fig. 8, a photograph which was taken several minutes after the arc had started. Fig. 9 shows the same arc taken at the instant of throwing it on the circuit and when the anode was quite cold. This seems to indicate that the temperature of the positive is responsible for the phenomena, and emphasizes the importance of preserving as clean a surface as possible on the anode. It might be well to add that when the photograph shown in Fig. 7 was taken there were traces of titanium oxide on the copper electrode, hence the reason for the luminous area at the upper end of the flame.



FIGS. 3 TO 10.—PHOTOGRAPHIC VIEWS OF THE MAGNETITE ARC.

In conclusion it might be well to state that when preparing electrodes the various materials should be in as finely a divided state as possible. Should the ingredients occur in concentrated masses throughout the electrode the arc will not burn with a uniform color. For instance, if the arc issues from a point where magnetite only is present the flame turns blue and presents a very smoky appearance, as shown in Fig. 10. While such refinements may appear trifling, they have considerable bearing on the commercial success of the lamp and should by no means be overlooked.

Electric Furnaces for the Iron and Brass Foundry.

By John B. C. Kershaw.

Electricity is undoubtedly an expensive heating agent, and, at first sight, proposals to employ it for producing molten metal for casting may appear to be not worth the consideration of practical men.

The equation for the heat equivalent of the output from an engine when converted into heat, by causing the electric current produced by it to pass through a resistance, is the following:

$$H = .393\,\eta\,P$$

in which H represents the heat produced per second in pound-centigrade units, P represents the indicated horse-power of the engine, and η represents the combined efficiency of the engine and the dynamo.

In a generating plant of the most modern type with a combined efficiency of engines and dynamos of 85 per cent, and using 3.5 lb. of coal per kw-hour generated (equivalent to 2.6 lb. per electrical hp-hour) the following comparison may be made: Heat produced by burning 2.6 lb. of coal, testing 7900 centigrade units per lb. = 20,540 units.

Heat produced by one hp-hour after conversion into electric energy, and use of this energy to produce heat:

$$.393 \times 1 \times .85 \times 3600 = 1201 \text{ lb.—centigrade units.}$$

The ratio between the heat available in the coal burned and that produced by electric energy is thus $\frac{20,540}{1201}$, or $\frac{17}{1}$, and as already stated, when studied in this manner, the proposal to employ electric methods of heating in the iron and brass foundry seems to offer no practical advantage. Even should the electric energy be generated by means of waterfalls, the economic advantage would seem to be on the side of the use of coke for heating purposes, unless the energy could be sold to the consumer at a very low rate, about one-half the lowest rate yet quoted for electric energy, even in Norway and Switzerland. Unless, therefore, some very important and valuable advantages result from the use of electricity as a heating agent, its application in the iron and brass foundry is an innovation which must be long postponed. It is the purpose of the writer in this article to point out what these advantages are and to describe some of the forms of furnace which might be employed for this special purpose.

Advantages offered by electric methods of heating.

The first and most important of the advantages is that the heat can be generated where it is required; that is, within the mass of metal to be melted, and that the efficiency of the resistance type of furnace may by careful work be raised to over 75 per cent. The losses from radiation and conduction are, in fact, greatly reduced as compared with the usual methods of work. How large the heat losses are in metallurgical operations, as ordinarily carried on, can be gaged from the following tabular statement prepared by Prof. Burgess, of the University of Wisconsin:

Product.	Type of furnace.	Per cent thermal efficiency.
Cast iron	Blast	52.6
Steel	Acid process	11.9
Steel	Basic process	10.0
Pig iron	Reverberatory	8.5
Wrought iron	Reverberatory	5.0
Steel	Siemens crucible	4.0
Steel	Greenwood crucible	2.0

The blast furnace stands in a category by itself, and it will be many years before it is displaced. The values for the efficiency of the furnaces used for producing steel and wrought iron were calculated by comparing the heat theoretically required to raise the metal to the molten state with that present in the fuel actually required to produce the effect in practice.

If these efficiencies be accepted as correct, the superior economy of direct heating by fuel largely disappears, for when from nine-tenths to nineteen-twentieths of the heat value of the fuel is lost, and only from one-tenth to one-twentieth is successfully utilized, the two methods of heating are practically on a level.

A second advantage offered by electric heating is that the furnaces and crucibles would have longer life than by the usual methods of work, since they would not be exposed to any external heating, and the highest temperature would be attained within the mass of metal they contained rather than at the exterior of the furnace or crucible walls. Another advantage no less important is that the metal during the melting operation need not be exposed to the air or to the products of combustion of the fuel used, and that, therefore, some of the losses due to the formation of oxides and dross would be avoided. In the melting of the finer kinds of steel, the possibility of conducting the melting operation under the surface of a protective flux or in an inert atmosphere is of considerable value. The final advantage which will be named here is the cleanliness with which the melting of the metal could be carried on. When coal or coke is employed for heating furnaces or crucibles, a certain amount of the ash of the fuel, which is always present as dust in the atmosphere of the building, must get into the molten metal, and the silica, which is the main constituent of this ash, may have prejudicial effect upon the physical properties of the finished metal. With the better forms of electric heating the contamination of the product is impossible, and the chemical constitution of the finished metal can, therefore, be more accurately gaged and controlled.

Electric furnaces suitable for melting iron and brass.

Electric furnaces are of either the arc or the resistor type. In this article only furnaces of the latter class will be described, since arc furnaces are not suited for the work required.

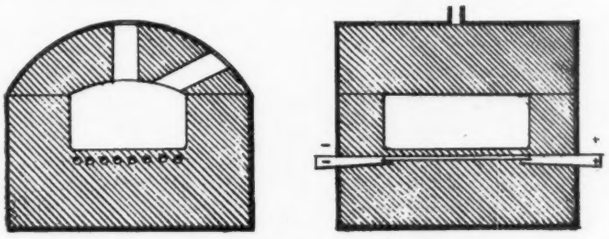
Electricity can be employed for resistor heating in several ways. In furnaces of the first type the crucible is embedded in infusible resistor material, such as granulated carbon, carborundum or "kryptol," and the heat effect is produced by heat transmission through the furnace walls. This type of furnace sacrifices some of the high efficiency expected with the adoption of electric heating, since the heating is external and the losses from radiation may be fairly high. In furnaces of the second type the metal to be melted is used as the resistor; that is, the heat is generated internally and the full advantage of electric heating is obtained. The electricity in this type of furnace is either passed directly through the metal by aid of a suitable conducting medium, or the heat effect is produced by induced currents, using the metal to be melted as the secondary circuit of a furnace erected on the transformer plan. In all cases alternating current is used, since this is more easily controlled than direct current, and the dangers of electrolytic action are obviated.

The temperatures required will range from 900 deg. C., equivalent to 1652 deg. Fahr., for melting brass, up to 1375 deg. C., equivalent to 2507 deg. Fahr., the temperature at which steel melts. The actual current strength required with the particular furnace employed can be ascertained only by actual experiment. The e.m.f., of course, varies with the thickness of the resistor between the two current terminals and it will generally be found best to work with a current supplied at low e.m.f., say, from 50 to 100 volts. The following figures from an article by Vogel upon electric resistor furnaces using solid carbon electrodes as the resistor material will serve as a rough guide to the current strength demanded:

Temperature.	Amperes per sq. mm of cross-section of carbon resistor.
590° C.	.25
710° C.	.33
990° C. brass melted	.45
1,110° C.	.54
1,210° C. cast iron melted	.66
1,600° C.	1.20
1,850° C.	1.60
2,300° C.	2.00

The limits of temperature between which the furnaces for brass and steel melting would operate are, therefore, represented by current densities of from .45 to 1.20 amperes per square mm of cross-section of the resistor material, when this in solid carbon. With the other materials—granulated carbon, graphite and carborundum—the current densities will be somewhat lower, since their electrical conductivity in the granulated state will be less than that of solid carbon electrodes.

One of the earliest electric resistor furnaces designed was patented by Faure in 1883. Figs. 1 and 2 show the construction of this furnace, which was built of firebrick on the usual lines of a reverberatory furnace, but in the bed eight channels were filled with resistor material. These resistors were connected, as shown in Fig. 2, to the current mains supplying electric energy at low potential, but large amperage. The heat produced in the bed of the furnace was thus communicated to the charge lying above it, and by varying the current intensity different temperatures could be attained. Although this furnace has not to the writer's knowledge been employed in electro-



FIGS. 1 AND 2.—FAURE'S RESISTOR FURNACE.

metallurgy, its simplicity and adaptability to many purposes are points in its favor. Good heat insulation of the bed would be necessary, however, to prevent large losses by radiation.

A crucible form of furnace, heated by an external resistance in which the crucible is embedded, is shown in sectional elevation in Fig. 3. This form of crucible furnace is the invention of Girod, and it is in use for the production of ferro-alloys not requiring a temperature above 1500 deg. C. at three works owned by the Société Anonyme Electro-metallurgique Procèdes Paul Girod.

Graphite, silicon and carborundum are employed as resistor materials with the Girod crucible furnaces. Furnaces of this type, each using 200 horse-power and producing from 1000 to 2000 kgs of ferro-alloys per day, have been successfully operated since 1903 in the three works at Ugine, Courtpin and Montbovon, and there is no doubt that these furnaces could be employed with success for melting steel or brass.

A detailed description of the erection of a small laboratory crucible furnace of the same type, using granular graphitized coke as resistance material, is given by Fitzgerald in the *Electrochemical and Metallurgical Industry*, February, 1905. Readers anxious to experiment with electric heating in the foundry are advised to consult this article, since details are given in it which cannot be reproduced here on account of the limits of available space.

The crucible form of furnace heated by an external resistor can be adapted for either tapping or pouring the molten metal and can, therefore, be modified to suit foundry requirements.

Turning now to electrical-resistor furnaces of the second and more economical type, in which the heat is generated internally by the resistance of the metal itself, four furnaces demand notice, namely those of Héroult, Keller, Kjellin and Colby.

In the Héroult furnace, shown in sectional elevation in Figs. 4 and 5, two massive carbon electrodes are employed to conduct the electricity into and away from the charge of molten metal contained within the furnace. These electrodes just touch the surface of the flux covering the metal, and the heat effect is produced by the resistance of the flux and metal lying between them. In order to adapt this furnace for melting operations and temperatures below 1500 deg. C. it is necessary to exclude the preliminary arc heating. This is effected by always leaving a third or more of the molten contents in the furnace after pouring. The carbon electrodes can then be kept in contact with the flux lying above this residual metal, and the resistor heating can be continued while fresh raw materials are charged. The possibility of increasing the carbon contents of the finished metal is always present with the Héroult furnace when used in this way, and, therefore, it is not adapted for melting the finer varieties of iron and steel. The choice of a suitable protective flux, which shall act as a heating medium, and yet be without action on the constituents of the molten metal, is also another difficulty connected with the operation of the Héroult furnace for foundry purposes.

The Keller resistor furnace is shown in sectional elevation in Fig. 6. In principle it is the same as the Héroult furnace, but the constructional details differ. The massive carbon electrodes are separated, and each is enclosed in a vertical shaft, these shafts being connected below by a lateral canal. The electricity passes from one electrode to the other, by the materials present in these two shafts and in the lateral canal.

The modifications required to adapt it for foundry work are those already named in discussing the Héroult furnace, namely, the prevention of arc-heating by only partial discharge of its contents and the provision of a suitable flux or slag, to protect the molten metal from contact with the electrode carbons or with the atmosphere. This furnace is designed for discharge by tapping.

The last types of resistor furnace which will be referred to in this article are the induction furnaces of Kjellin and Colby. Figs. 7 and 8 show views of the Kjellin furnace. It is in effect a large transformer, in which an alternating current of low amperage, but high voltage in the primary coil *A*, is transformed into a current of large amperage, but low voltage in the secondary coil of the apparatus, which in this case is the molten metal and flux contained in the annular ring *B B*. The Colby furnace is similar in design, the chief difference being that the primary coil is made of copper tube, and is kept cool

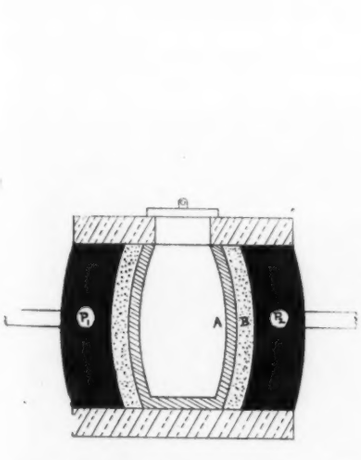
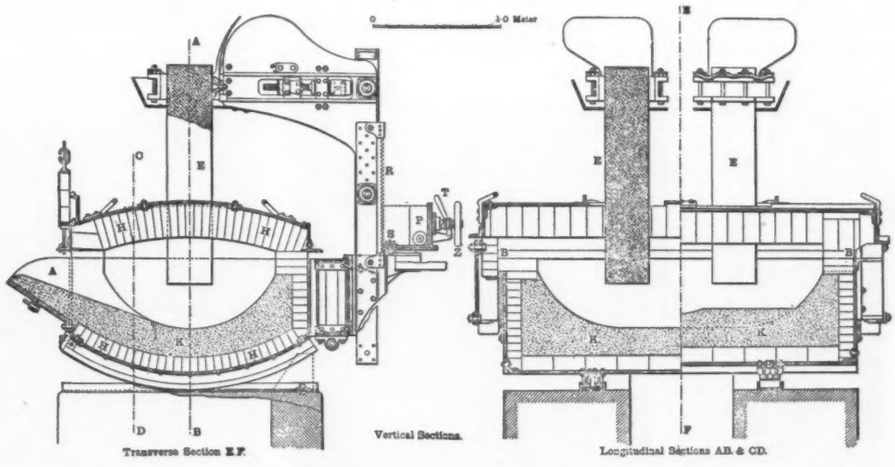


FIG. 3.—GIROD'S CRUCIBLE FURNACE.



FIGS. 4 AND 5.—HÉRAULT'S ARC AND RESISTOR FURNACE.

by water flowing through it during the operation of the furnace. Fig. 9 is a photograph of a small 15-kw experimental Kjellin furnace built at Messrs. Vicars' Steel Works, in Sheffield, England, while Fig. 10 is a photograph of a 300-kw furnace in operation at the Gysinge Works, in Sweden.

It will be observed that both these furnaces are mounted on trunnions so that they can be tilted for discharge. The smaller

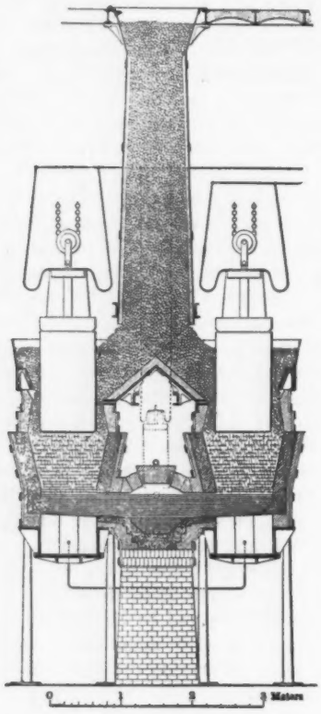
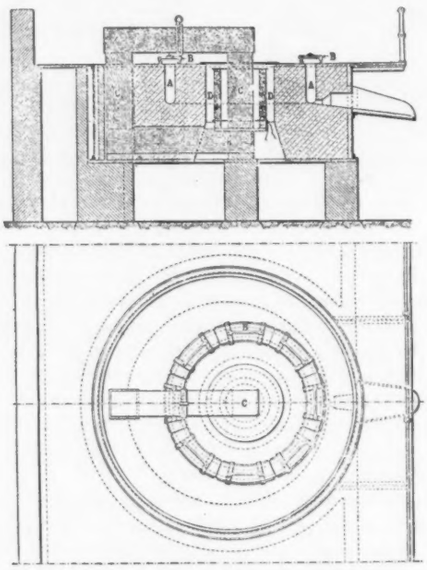


FIG. 6.—KELLER'S RESISTOR FURNACE.



FIGS. 7 AND 8.—KJELLIN'S INDUCTION FURNACE.

furnace will melt 30 lb. of metal in from 20 to 30 minutes, and it operates at a power factor of from 57 per cent to 60 per cent. The larger furnace produces 4100 kg (9000 lb.) of steel ingots per 24-hour day in fine castings, 800 to 1000 kg of metal being poured at each stoppage. The energy consumption is 866 kw-hours per ton of 2000 lb. The corresponding values for the 40-kw Colby furnace erected at the Tacony Works of Messrs.

FIG. 9.—KJELLIN FURNACE AT SHEFFIELD.

H. Disston & Sons, near Philadelphia, are from 550 to 750 kw-hours per ton of 2000 lb., 90-lb. ingots being poured off hourly, and 100 lb. of molten metal being left in the furnace as basis of the next charge.

In this furnace the fusion of the metal was effected in 30 minutes, and a further 30 minutes heating was required to complete the refining process.

CONCLUSIONS.

The above figures give some indication of the energy that would be required in the practical operation of these furnaces for melting steel or brass, since about one-half the electric energy is employed to effect the refining process. As a general rule, one may estimate that from 400 to 500 kw-hours would be sufficient to melt one ton of metal in these resistor furnaces with internal heating, and that with cheap electric energy (say, $10 per hp-year) the cost would not exceed 75 cents per ton. The writer does not suggest, however, that a large furnace for electric heating of the metal required daily in any brass or iron foundry should be erected without preliminary trials in the laboratory or upon a small industrial scale. Each case will demand special consideration by an expert electrometallurgist with no private axe to grind, and it is quite certain that there will be many cases in which no change can be recommended, as there would be nothing gained by substitution of electric for the ordinary methods of heating.

In particular cases and industries, however, especially those relating to the production of fine castings in iron, steel or brass, electrothermal methods have much in their favor, while the facts and values given in this article prove that the electric method of working may compare favorably as regards cost with the older process.

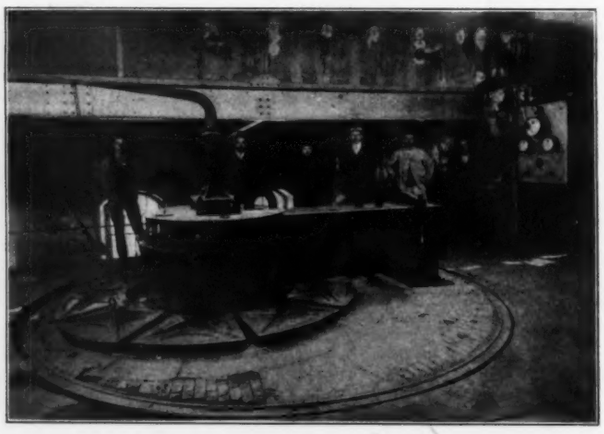


FIG. 10.—KJELLIN FURNACE AT GYSINGE.

"Over Shooting": A New Observation on Tungsten Incandescent Lamps.

By John B. Taylor.

The filament in the well-known carbon incandescent lamp has a negative temperature-resistance coefficient. That is to say, an increase of voltage gives a more than corresponding increase of current, and when connected to a source of constant potential, the current starts at a comparatively low value and increases to a maximum when the lamp has reached full candle power.

The filament in the tungsten incandescent lamp, on the other hand, has a positive temperature-resistance coefficient, which is equivalent to saying that an increase in voltage increases the current in a smaller proportion, and when connected to a constant-potential supply, the current is greatest while the lamp is cold and falls off to its final value as the lamp comes up to full brilliancy. The most noticeable effect due to these different characteristics is the fact that a tungsten lamp comes up to full candle power almost instantly, while a carbon incandescent lamp reaches full brilliancy only after a plainly noticeable interval of time.

The quicker response of the tungsten lamp on closing the circuit is a matter of common observation and has been previously thoroughly discussed. Soon after installing one or two tungsten lamps, the writer had the impression that the lamps "over shot" for a brief fraction of a second after closing the switch. That is to say, if the lamp normally gave 40 candle-power for the brief fraction of a second, the candle-power was greater—for the sake of argument, let us say 50 candle-power. This apparent temporary increase of candle-power was called to the attention of a number of people and it was then found that others had received the same impression, but in general had ascribed it to some physiological action connected possibly with the slow contraction of the retina of the eye, due to the suddenness of the light. This explanation did not seem satisfactory, as, if correct, similar impressions should be a matter of common experience. For example, a rapidly moving railroad train brings the observer suddenly into light of an incandescent lamp or arc lamp, and while this light may be dazzling, there is no impression of "over shooting."

While endeavoring to check this impression with a tungsten lamp, it appeared that the "over shooting" effect was most noticeable if the lamp was cold before closing the switch. If a tungsten lamp is turned out, and then lighted again within a second or two, the "over shooting" effect is not noticeable. This impression was also checked by others.

In order to demonstrate definitely whether such "over shooting" is a physical or physiological fact, the light from a tungsten lamp was allowed to fall on a moving photographic film so that any variation or "over shooting" of the light would give a corresponding change in opacity of the photographic film. This test was very easily made by taking a film drum and holder of the standard General Electric oscillograph and placing the same in a screw cutting lathe. A piece of cardboard with ⅛-in. slit was fastened to the tool post so that the travel of the lathe carriage caused this slit to move across the slit in the film holder. By this means the velocity of the film and the cross travel of the slit were very easily arranged without any special apparatus, and test was made on tungsten lamps of different voltage and candle power as well as on carbon incandescent lamps for the sake of comparison.

The development of the film demonstrated definitely that for a period of the order of 1/10 of a second, the light coming from the lamp is greater than normal. It could also be noticed that the test was made on an alternating 60-cycle circuit and the alternate heating and cooling of the filament for each alternation is made evident by the striations.

Some little experimenting may be required to obtain the exposure that will make this phenomenon most plainly evident. It is believed that what might be termed an "under exposure" by placing the light some distance from the film and somewhat prolonged development will make the contrast between the light and dark parts of the record more pronounced.

The explanation of this phenomenon is at present little better than a conjecture, but it is assumed that the small amount of residual gas in the lamp is attracted to the walls of the globe while the lamp is cold, and after the lamp is lighted and becomes warm, this residual gas is driven off, making the vacuum relatively less. While the vacuum is high, practically all the energy must be radiated from the filament, and when the vacuum is not so good some of the heat is carried away by convection and conduction. If all the heat must be dissipated by radiation, the filament will run at higher temperature and hence give more light. To prove or disprove this theory would require much investigation for which the writer has no facilities. It is hoped that this information may lead some of those who are better equipped for such investigation to explain the phenomenon.

New Telephone Patents.

NEW INSTRUMENTS.

Telephone users have always been annoyed to some extent by the escape of sounds directed toward the instruments, and by the admission of extraneous sounds both to the instruments and to the exposed ear of the user. There have been numerous attempts to overcome this defect, but apparently all have introduced more difficulty than that to be overcome. Recently there have been patented several instruments which include a muffling feature, although in some it is merely incidental.

A muffler for the idle ear forms the subject of a patent granted jointly to J. F. Hirsh and H. M. Hirsh, of St. Louis. This consists of a hemispherical shell carried upon a headband, and consisting of two shells of metal with a felt pad held between them. The felt projects some distance and serves as a packing between the muffler and the head of the user.

According to the invention of C. E. Cole, of Birmingham, Ala., the transmitter mouthpiece is formed at its edge to fit the face of the user, while the receiver mouthpiece is provided with an extension lip for the same purpose. An additional feature of these instruments is a movable diaphragm set transversely to the sound passage. This affords a means of adjusting the efficiency of the instrument by varying the size of this sound passage. The shutters are normally held open by springs, but are under control of a pressure of the finger.

O. J. Davy, of Washington, D. C., has patented an arrangement for the use of the deaf which includes two miniature receivers. A head band carries one of these at each end, and the mouthpieces are formed out into cones to fit the orifice of the ear. The patent relates chiefly to the method of construction.

Letters to the Editors.

Electromagnetic Force.

To the Editors of Electrical World:

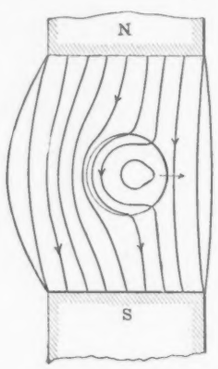
Sirs:—I have read with interest the article by Dr. A. S. McAllister in your issue of April 11, and believe that much good will result from a thorough discussion of such questions, many of which are often very confusing to the student and sometimes also to the scientist and practicing engineer. I agree with him that there is much room for improvement in the methods of teaching some of these subjects. I cannot, however, agree with all his statements, as I understand them.

Concerning the questions raised by him, I believe the following statements are generally accepted for the case of a conductor carrying a current and located in a magnetic field, the conductor having flux around and inside of it due to the current. 1. That the force which tends to move the conductor across the field can be only that exerted by the two fluxes and nothing else, as there is no medium (besides the ether) between the conductor and the poles, except air, which we know does not transit this force; no other force but that of the flux is

known. 2. The only known forces which so-called magnetic lines of force can exert, are a tensional force in the direction of their length, and a repellant force between neighboring like lines of force. 3. That the flux density behind such a conductor in an external magnetic field, must necessarily always be denser than in front of it; it cannot possibly be uniform. 4. That the force is probably independent (or very nearly so) of the total fluxes behind and in front of the wire, and is dependent only on some relation of the fluxes immediately in front of and behind it. The distribution of the flux will probably be approximately as shown in the accompanying illustration, in which each line represents a unit of flux.

Hence it seems to follow that the force which tends to move the wire consists entirely of the tensile force of the flux in combination with the mutually repellant force existing between like lines of force. Any further explanation of this phenomenon which may be given in the text books to which Dr. McAllister objects, may or may not be conjectural, but those given above, at least are presumably accepted. In referring to the flux in front of and behind the wire, the center line of the flux in the wire is meant as that part of the current flux (or local flux as he calls it) which is inside of the wire, as also that part of the original field which passes through the wire will also contribute to the mechanical force.

Dr. McAllister states that the "electromagnetic force is *not* a function of the flux surrounding (or within) a conductor locally; it is related, however, to that which *tends* to produce local flux." According to our present knowledge it seems to me that the only forces which can exist in this case are those



MAGNETIC DISTORTION.

due to the fluxes which actually exist, as distinguished from the fluxes which only tend to exist. Hence, if this is correct, the force which does exist must be due solely and only to flux which does exist; when fluxes tend to exist but balance each other (like those of two opposite currents close together) and therefore do not actually exist, no mechanical force will exist either, as such a non-inductive conductor has no tendency to move across the field like a single one.

That the reactance of a small free wire is greater than that of a large one is explained by the fact that for the same current there are more lines of force generated around and outside of a small wire than a large one. Reactance or self-induction is explained as being due to the counter e.m.f. induced by its own flux cutting the wire itself. The flux generated in the inside of the wire is, however, the same for both large and small wires for the same current.

In his Fig. 4, in which the conductor is double and is arranged non-inductively, Dr. McAllister states that there is a force acting on each one. How does he know this? Have we not just as much right to say that as the tendencies to generate fluxes by the current are assumed to be balanced there will be no such fluxes and therefore no mechanical force acting on either wire? The latter would seem to be the more rational explanation. The small resulting force which does exist in the case of a double wire is a rotary one tending to turn that double wire so that it will become parallel to the field.

Dr. McAllister appears to deny that the force on a conductor is doubled "when placed in proximity to a similar conductor carrying an equal current in the same direction." If both conductors move together the total combined force of both will be doubled according to the formula, the correctness of which he says he does not question. If he meant that only one conductor moves, the problem becomes complicated and the result cannot be stated off hand, as it will vary with the conditions.

Dr. McAllister seems to feel sure that in his Fig. 3, in which the conductor is placed within an iron tube, the force will still be the same as before. It would be interesting to know whether this has been confirmed by experiment. Without having made the test it is natural to suppose that the iron tube would shield the conductor from the flux of the original field, and that the force to move the wire in the tube would therefore become very much less, as the flux density inside of the tube would be far less than the original field was. This assumes that the iron tube is stationary and the wire is free to move inside of it. If the tube and the wire are fastened together and move as one piece, the problem becomes very complicated and the result would probably vary considerably with different numerical values, as the permeability of the tube would enter into the result.

Dr. McAllister does not question the formula $f = H l i$; that is, that the force is equal to the product of the flux density (of the original stationary field), the length of the conductor and the current (all in absolute units). Has it been established that this is really a perfect general or universal law, or is it limited to special conditions? According to this formula the force is quite independent of the diameter of the wire and the shape of its cross section, if the formula is really general. Is the formula limited to the condition that the field must be large relatively to the size of the wire, and strong relatively to the field generated by the current in the wire? If so, it is not a general but a special law. Does it take into account the greater external flux generated by the same current when the wire is small, or, as Dr. McAllister states it, the greater reactance of a smaller wire? Does it include the case in which the flux generated by the current in the wire is much stronger than the original field, strong enough, let us say, to overbalance and even reverse the flux of the original field? If the formula does not include all these cases, in which nothing but the numerical values are changed, it is not a general law, and we have been mislead in assuming it to be so.

Philadelphia, Pa. Carl Hering.

To the Editors of Electrical World:

Sirs:—The question which Mr. Hering raises concerning the electromagnetic force relation when a conductor is surrounded by material of high permeability is convincingly answered by the operation of dynamos with embedded armature conductors in which the torque depends upon the product of the main field flux and the armature ampere-conductors equally as much as though the conductors were not embedded.

It seems well to call attention to the fact that the force which is exerted by a magnetic field upon a conductor carrying a current parallel to, and in opposite direction to, an equal current, is not "small," but it has the value represented by the equation, $f = H l i$, as the operation of the Thompson-Ryan dynamos fully proves.

That the expression $f = H l i$ is correct for the electromagnetic force under all conditions can be shown very simply by a demonstration based on the one "law" of physics which has never been questioned; namely, that relating to the conservation of energy. It may safely be stated that wherever motion produces or utilizes energy, force must be present; and the energy, when considered in connection with the distance, affords a measure of the force.

Assume that the force f due to a current i in a conductor of length l situated in a main field of density H, produces motion through a minute distance Δs in a time Δt. The mechani-

cal energy will be $f \Delta s$. The electromotive force will be $Hl \frac{\Delta s}{\Delta t}$, the electrical power will be $H l \frac{\Delta s}{\Delta t} i$ and the electrical energy $H l \Delta s i$. This energy must equal the mechanical energy; hence $H l i = f$. The above equations are absolutely general, and they apply under every conceivable condition.

As a result of the relations shown by the above expression for electromagnetic force, each element of a conductor carrying a current in a magnetic field experiences a force which varies directly with the product of the current and the "main field"; the main field being considered as that flux which would cause an e.m.f. to be generated in the conductor if it moved under the action of the force. The value of this force is altered only when changes are made in either the current in the conductor or in the main field. Contrary to the interpretations which one is compelled to give to the usual explanations of electromagnetic force, the force does not bear any simple quantitative relation to the flux which surrounds a conductor locally, although qualitatively the conception of the distorting influence of the local flux upon the main field flux is of help in assigning direction (not value) to the force.

In this connection it should be noted that the direction of the force is not *always* from the position where the flux is densest to the place where the lines are more widely scattered, the usual explanation to the contrary notwithstanding. In a main field that is normally not uniform the force may tend to move the conductor toward the denser field.

NEW YORK, N. Y. A. S. MCALLISTER.

Cutting vs. Looping Lines of Force.

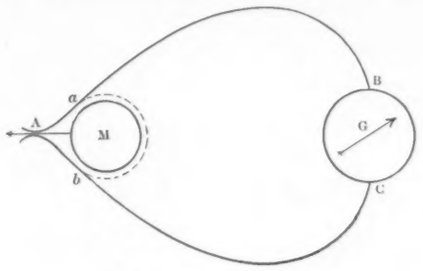
To the Editors of Electrical World:

SIRS:—I have read with much interest Mr. Hering's article in your issue of March 14, on "A New Factor in Induction; the 'Loop' vs. the 'Cutting Lines of Force' Laws," and also a similar article by the same author in the *Proceedings* of the American Institute of Electrical Engineers for March. While agreeing with Mr. Hering that, in many cases, Faraday's statement of the fundamental law of electromagnetic induction may be "simpler," "safer," "more direct" and "much easier for students to learn and comprehend" than Maxwell's, I cannot see that Maxwell's statement of it is "imperfect and that it requires to be modified in order to become universal."

If I may be permitted, I should like to offer through your columns an explanation of Mr. Hering's experiments which does not make them conflict with Maxwell's statement of the fundamental law of electromagnetic induction, and which does not seem to the writer to add any "conditions," "restrictions" or "complicated interpretations" to Maxwell's law as it is *ordinarily* understood.

In discussing in your journal one of Faraday's own experiments, Mr. Hering added a dotted line to Faraday's original figure "to indicate the center line of the path of the current or the completion of the electric circuit." It seems to the writer that the entire copper strip must be considered part of the galvanometer circuit according to Maxwell's use of this word, and that there are no lines of magnetic induction linking this circuit. Inside the copper strip itself there is an infinite number of electric circuits. When these circuits are moved across the magnetic field, an electromotive force is produced in these circuits and eddy currents are caused in the copper strip (unless the field is uniform over the entire strip). The current through the galvanometer is due to the fact that it is shunted across some of these circuits. When the magnet and copper plate are moved together, there is no change in the flux enclosed by *any* circuit and therefore no electromotive force or current produced.

The experiment described in the *Proceedings* of the American Institute of Electrical Engineers is capable of a similar explanation. The accompanying illustration shows very simply Mr. Hering's experiment. *M* is the section of a magnet perpendicular to the plane of the circuit *A B C*, which is in series with the galvanometer *G*. If *M* is suddenly removed from the circuit in the direction shown by the arrow, the original circuit opens at *A*, but the galvanometer circuit is never broken, because it is completed through the magnet. In this case Mr. Hering found that there was no current induced in the galvanometer circuit, and concludes that "it is possible to link and unlink a flux with a closed electric circuit without any induction." The writer cannot see that Maxwell's law would lead us to expect any current in this case, for it does not seem that there has been any true unlinking of magnetic lines from the *galvanometer* circuit. In order to explain what apparently takes place, suppose that, before the magnet is moved, the



GALVANOMETER CIRCUIT.

galvanometer is shunted by the wire *a b*. Now, if the circuit *A a b* is opened at A, the magnet can be removed in any way desired without producing an electromotive force in the galvanometer circuit and yet the galvanometer circuit has not been broken. The above seems a fair analogy of what happens in Mr. Hering's experiment. As soon as the magnet comes in contact with the wires *A B* and *A C*, the entire magnet becomes a part of the galvanometer circuit and there are no longer any lines of magnetic induction linking this circuit. Mr. Hering states that the flux was unlinked without opening the circuit. This is true, if he refers to the galvanometer circuit, but not if he refers to the circuit which originally contained the flux.

If the above analogy is true, then it is not established that "it is possible to link and unlink a flux with a closed electric circuit without any induction."

MCGILL UNIVERSITY. HOWARD L. BRONSON.

To the Editors of Electrical World:

SIRS:—The experiment of Faraday, as discussed by Mr. Carl Hering in your issue for March 14, it seems to me, can be explained on the basis of Maxwell's statement of the "law of electromagnetic induction." Referring to Fig. 1, reproduced from Mr. Hering's article, as the strip *C* is moved in the direction of the arrow the flux enclosed by the galvanometer circuit is increased provided all of the strip *C* is included in the circuit (as it properly should be), due to the increasing area enclosed by the electric circuit. If, however, the strip *C* and magnet *N* are simultaneously moved in the direction of the

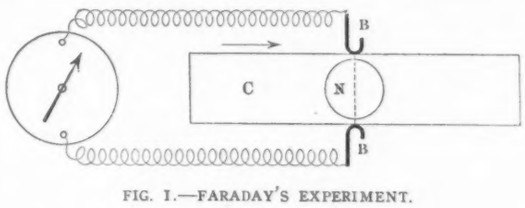


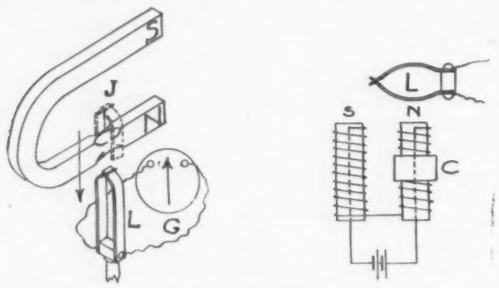
FIG. 1.—FARADAY'S EXPERIMENT.

arrow the area enclosed by the electric circuit is increased and the flux per unit of area is decreased and there will be no appreciable resulting e.m.f. generated in the electric circuit.

In his recent paper on "Electromagnetic Induction," published in the *Proceedings* of the American Institute of Electrical Engineers, Mr. Hering claims to obtain unlinking of the electric and magnetic circuits when the spring-jawed strip of Fig. 2 is drawn over the horseshoe magnetic. I consider, however, that he has merely separated the electric circuit into two circuits, one of which is the spring-jawed loop and the

other is the material of the magnet over which the loop has been drawn. The spring loop still encloses the leakage flux that it also enclosed when surrounding the bar of the magnet, and the material of the magnet encloses the flux through the bar of the magnet. Since the galvanometer is attached to that portion of the circuit which encloses the leakage flux only, and this has not appreciably changed, there will be no deflection. It is as though that portion of the electric circuit enclosing the main flux had been short circuited and then cut off from the loop.

This view of the experiment seems still further confirmed by an examination of Fig. 3, in which there are two loops



FIGS. 2 AND 3.—HERING'S EXPERIMENTS.

surrounding the electro magnet, one being the copper ring and the other the spring-jawed loop *L*. When the spring loop is drawn over the ring what really takes place is as follows: The moment the springs touch the ring the electric circuit becomes short circuited and the flux through the solenoid is no longer enclosed by that portion attached to the galvanometer, hence the withdrawal of the spring loop does not affect the galvanometer because the only flux actually enclosed is the leakage flux outside of the solenoid and this does not appreciably change.

ELECTRA, CAL. J. P. JOLLYMAN.

Distortion in Telephonic Transmission.

To the Editors of Electrical World:

SIRS:—Mr. Louis Cohen states in his article on "Distortion in Telephonic Transmission" in your issue of Sept. 21, 1907, page 564, that "one vital point in connection with this subject was entirely overlooked by the preceding investigators," referring to an increase of resistance, which is, according to his calculations, about 7 per cent.

Mr. Cohen neglects totally the value of *K*, or coefficient of leakage, which is assumed in his calculations to be zero. *K* can never be zero; the energy represented by E^2K is many times—1000 to 10,000 times—greater than that customarily calculated from the formula I^2R. I have measured by my barretter method the value of *K*, and have never found it 10^{-6} mho, but always greater. The increase of *K* with frequency is very rapid. Taking the values of *K* in the following correct formula of β we have the following results:

$\omega^2 =$	$K =$	$\beta =$	$\frac{\omega}{2\pi}$ = c a.
4×10^7	10^{-6}	18.4×10^{-4}	1000
4×10^8	5×10^{-6}	31.6×10^{-4}	3000
1.4×10^9	10^{-5}	47.4×10^{-4}	6000
3×10^9	5×10^{-5}	$173. \times 10^{-4}$	9000
6×10^9	10^{-4}	$330. \times 10^{-4}$	12,000

where the values of *L*, *R*, *C* are the same as those given by Mr. Cohen, but with a value of *K* which varied with the frequency between 10^{-6} and 10^{-4} mhos per mile. It will be seen that the difference between this calculation and that of Mr. Cohen is very great. I find that European telephone receivers do not respond to frequencies higher than 8000, and thus the distortion caused by an aerial line is not so serious.

A distortionless circuit of 6000 frequency, β, would correspond to $\sqrt{10^{-5} \times 2} = 44.7 \times 10^{-4}$; that is, very near to the (calculated) 47.4×10^{-4}. $\frac{R}{L}$ would be $\frac{2}{4 \times 10^{-3}} = 0.5 \times 10^{-3}$, or about the same, while $\frac{K}{C}$ varies as 10^2, 5×10^2, 10^3, 5×10^3, 10^4.

The main variation is caused by *K;* this is the vital point which I had pointed out in the *Electrician,* 1906, Nov., p. 81, and I should be glad to have that investigation known to American telephone engineers.

BUDAPEST, HUNGARY. BÉLA GÁTI.

Patent Abuses.

To the Editors of Electrical World:

SIRS:—The writer finds it impossible to withstand the temptation to add his mite to the interesting United States patent discussion in your valuable paper by Mr. H. Ward Leonard, Mr. Ludwig Gutmann and Mr. J. Nikonow.

I have had considerable experience in the matter of patent litigation and United States patents in general, and I most heartily agree with the gentlemen above-mentioned that something radical needs to be done, and done quickly. The company with which I am connected has suffered acutely during the past four or five years as the victim of trumped-up patent litigation and no remodeling of the United States patent laws will be adequate or just which does not take into consideration this very important detail.

We have had the experience of having two electrical manufacturing corporations join together, employ a large firm of patent attorneys and begin wholesale patent litigation, without even writing a letter of protest or suggesting to us in any way, shape or form that they considered their patents infringed upon. Long-drawn-out and exceedingly expensive litigation has been the result. The culmination in part of the cases has been that the patents have been declared invalid by the courts. In the majority of the remaining cases the complainants, after hearing our testimony, have come into court and asked for a dismissal of the cases at their expense, without a hearing by the judge. Some of the cases still remain and are to be classed with those already disposed of.

The firm to which I have referred has employed some of the best legal talent in the country and conferred with a large number of electrical manufacturing companies before deciding to stand suit on these cases. The unanimous judgment of those consulted has been that the litigation has no foundation in justice and was apparently brought simply for the purpose of driving smaller electrical manufacturing companies out of competition with larger concerns.

I took the matter up with the Department of Justice at Washington, D. C., and after laying before the department the facts in the case I concluded my letter with this sentence: "Now, to put the matter briefly, can you do anything for us?" I shortly received a long communication in reply and quote the letter in part, as follows: "You state that these companies are harassing you by the institution of trumped-up patent litigation. You will, of course, readily appreciate that the government is powerless to prevent the bringing of suits by corporations or individuals who believe that they have a cause of action against another corporation or individual."

This statement of the facts shows the need of new legislation. It seems to the writer that a patent law should be passed which would make it obligatory on the part of the government to investigate such conditions, and where any corporation or individual is found guilty of being engaged in malicious prosecution of its competitors by trumped-up patent litigation, that the government should forthwith declare invalid every patent owned, controlled or assigned to such corporation, and should in the future deny every privilege of the United States Department of Patents to such corporations or individuals.

Another feature of patent abuse, under present conditions, is that the large corporations seem to obtain a class of patents that individuals and small concerns cannot get. The concern

to which I refer has applied for United States patents on details which it seems to the writer were exceedingly meritorious and belong to a class upon which the large electrical manufacturing companies obtain patents right along, and yet our applications have been returned with such a string of citations as to immediately kill every hope of ever securing anything like a reasonable consideration of the application.

It has long been considered by the thoughtful owners of small and medium-size manufacturing establishments that a policy of secrecy concerning important improvements in details is often a much better course to follow than to give away the details of the improvement to the Patent Office and have it gobbled by unscrupulous and monopolistic manufacturing interests; and it is the writer's opinion that under present conditions a large class of inventions are better protected by a policy of secrecy than by United States patents. This is particularly true of processes of manufacture and of details of machines not usually subject to being dissected by the owner or by large competing concerns. There is a huge amount of arrogance and overbearance of disposition which characterizes some very large electrical manufacturing concerns, and a smaller concern may have a very superior article and do a nice business for a long time before the former find it out. This period of time may not be 17 years, but when the disadvantages of the patent situation are considered, a policy of secrecy may be quite as productive in the way of dollars and cents.

Under present conditions, letters patent are mostly licenses to begin law suits, and if the Electrical World can, through its valuable columns, be the means of helping to rectify United States patent abuse, it will have rendered a service of which it may well be proud.

Minneapolis, Minn. C. H. Chalmers.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

High-Speed Dynamos.—G. Stoney and A. H. Law.—A paper read before the (Brit.) Inst. Elec. Eng. indicating the chief features of the modern types of turbo-generators. The authors first discuss direct-current generators and deal with the effect of the compensating winding used by Parsons & Company. The advantages of a compensating winding are not only fixed brushes and better commutation, but the number of segments for any certain voltage may be reduced and the ampere-turns on a given diameter of armature may be increased. The change enables a larger output to be obtained for a certain speed or a higher speed to be used for a given output. Before compensating was adopted, 500 kilowatts at 1800 r.p.m. was the extreme limit of size for that speed, and the machine would not carry more than 10 per cent overload. At present, there is a 500-kw machine running at 3000 r.p.m. and a 750-kw machine running at 1800 r.p.m. carrying 30 per cent overload without

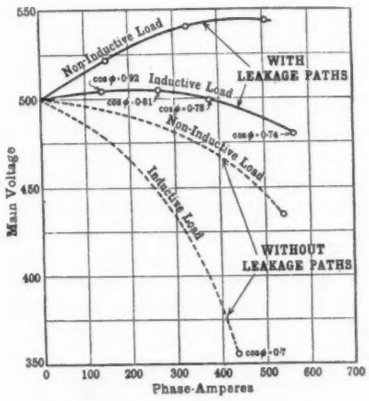


FIG. I.—VOLTAGE REGULATION.

sparking, and 50 per cent for a short time without injurious sparking. This improvement has enabled not only the cost of the turbine to be largely reduced, but also the steam consumption to be lowered by some 10 per cent. There is no difficulty in running such compensated dynamos in parallel with one another or with other types, although in all cases they are self-exciting. Brass-wire brushes running on a grooved commutator give the best results. The author deals with the design of high-speed alternators and discusses the question of ventilation. In selecting material for high-speed work, it is most desirable not to obtain high tensile strength at the expense of the ductility of the material. Reference is finally made to Parsons and Law's method of compounding alternators which avoids the difficulties where compounding is obtained by commutating the alternating current, by saturation or by altering the effective resistance of the magnet winding. The exciter is provided with an alternative path for the magnetism in parallel with the armature, which is called a "leakage path." This "leakage path" is provided with a winding, which is in series with the stator winding, and as the alternating current in this rises it chokes back the magnetism, or, in other words, increases the magnetic reluctance of the leakage path. Thus more flux goes through the armature, and, therefore, the voltage of the exciter rises and compensates for the tendency of the main voltage to drop. In a three-phase alternator there is generally one leakage path in each phase, and, if the primary current is at high voltage, a series transformer is generally used. These leakage paths are easily adjusted for any desired amount of compounding, or for any power factor. Fig. 1 gives the comparative regulation on varying load with and without the leakage path in action.—Lond. *Elec.*, April 3.

Rotary Converter.—E. J. Berg.—A continuation of his long mathematical serial in which he discusses the heating of rotary converters when supplying unbalanced load in a three-wire system, the neutral being derived from the transformers.—*Gen. Elec. Rev.*, April.

Three-Phase Motors.—W. Oelschlaeger.—A translation in abstract of his recent German paper on a method of calculating the short-circuit current in three-phase motors.—Lond. *Elec.*, March 13.

Lamps and Lighting.

Tungsten Lamp.—A. Lottermoser.—An article on Kuzel's method of making metallic filaments for incandescent lamps by the colloidal method of Kuzel. The author emphasizes that his notes are based not alone on Kuzel's patents, but on repeated visits to the factory of Julius Pintsch, who manufactures the Kuzel tungsten lamp. The tungsten is first comminuted to as fine a powder as possible by mechanical means. It is then subjected alternately to treatment with an acid and with an alkaline solution and washing with intermittent treatment with water. The tungsten (and many other metals, like molybdenum, titanium, silicon, thorium, etc.) thereby passes into the water as colloid and, therefore, becomes a "hydrosole." The colloid is then precipitated as a paste from the water by means of a suitable electrolyte. According to the author the nature and concentration of the electrolyte is very important, but he does not say what is used in practice. If the colloidal paste contains oxide (never more than 1.5 per cent oxygen) it can be easily reduced by heating in a reducting atmosphere of hydrogen. The further treatment of the filaments is the same as used in other processes. The filaments when pressed and dried are almost non-conductors of electricity. When heated in vacuo or in an inert atmosphere, the conductivity increases. The filaments contract when more strongly heated, and at white heat they become good conductors. They are then cut into the length required for filaments and are connected to the leading-in

wires by means of the same paste which serves for the manufacture of the filaments. This paste is treated by heating in the same way as the filament itself. Finally the globe is evacuated or filled with an inert atmosphere. The filaments produced in this way are claimed to be absolutely free from carbon and of absolutely uniform thickness all along their length. Under normal conditions they consume one watt per hefner candle, but if they are overloaded, for instance, so as to consume 0.31 watt per hefner candle, and if they are then brought back to normal condition, they are stated to behave just as if they had not been overloaded. The life is said to be 1000 hours. The preparatory mechanical comminution of the tungsten seems to be of great importance and the grinding machinery used on a large scale is far more effective than the equipment available in laboratories.—*Chemiker. Zeit.*, March 25.

Power.

Austrian Hydroelectric Plants.—An illustrated description of the Kindberg station which supplies several towns in the neighborhood. The power house contains two 150-hp turbines coupled to 3100-volt, three-phase alternators. The voltage of the secondary distribution network is partly 110 and partly 220. —*Elek. u. Masch.* (Vienna), March 1.—The Feistritz works contain two turbines driving two 324-kvolt ampere 10,200-volt, three-phase alternators. The transmission lines have a total length of 13 miles. The secondary e.m.f. for energy distribution in the different towns is 155 volts.—*Elek. u. Masch.* (Vienna), March 8.

Turbine Regulators.—R. Löwy.—An illustrated discussion of the process of regulation with modern indirectly-acting hydraulic turbine regulators.—*Elek. und Masch.* (Vienna), March 8 and 15.

Traction.

System of Electric Traction.—A note on a system of electric traction, due to Colonna, which is now being used on the Vesuvius Railway. The trains usually consist of two motor-cars, each carrying two 75-hp motors, which are electrically connected together in the following way: The main cable from the trolleys on each car is continued on to each of the platforms, where it ends in a socket. In the cable from the main conductor to the motor is placed a shunt whose ends are connected to two sockets fixed on the platform of each car. Two other conductors run the whole length of each car and are connected to the ammeter leads on the other car. The ammeters used are aperiodic and are worked by only a fraction of the total current. As they are not required to give accurate readings, but only indications, the length of the connecting leads is immaterial. Connection between the two cars is made by means of a five-core cable. The two trolleys are in parallel, but the regulating magnets and brake equipment are quite separate on each car. Each motorman watches the readings of the ammeter connected in the circuit of the other car and these readings ensure simultaneous operation. The motorman on the leading car is in command and all his movements are followed by the man on the second car. It is claimed that this system works quite well as, and is much cheaper than, the more general multiple-unit system.—Lond. *Elec.*, April 3.

Petrol-Electric Omnibus.—P. T. Smith and W. A. Stevens. —A paper read before the Society of Road Construction Engineers in London. The authors refer to the "appalling" financial losses of certain of the London motor-omnibus undertakings using the gear-driven petrol omnibus. The object of the paper is to show by diagrams and figures the saving in expense which may be obtained if the adoption of a "petrol-electric" vehicle were adopted in which an internal-combustion motor, direct-coupled to an electric generator, supplies electrical energy to electric motors, directly or indirectly connected to the road wheels, by which means the clutch, gear-box and differential gear are dispensed with.—Lond. *Elec. Eng'ing*, March 26.

Installations, Systems and Appliances.

Installation Rules.—W. P. Steinthal.—A comparison between the installation rules of the German Association of Elec. Eng. and those of the British Inst. of Elec. Eng. While the institution rules "are intended neither to take the place of a detailed specification nor to instruct untrained persons," the author thinks that if an installation is erected according to the regulations of the German association, no further specification could in any circumstances be required. Although the general tendencies of the two sets are similar, there are notable differences. From nine amperes to 20 amperes the current density in conductors permissible in Germany is three times or more, from 20 amperes to 200 amperes twice or more, from 200 amperes to 240 amperes 1½ times or more, and for 500 amperes 1.3 times that of the Brit. I. E. E. rules. There are also differences in thickness of insulation specified for different sizes of wire in England and Germany, and also with respect to insulation resistance. The cross-section of conductors employed for making earth-connections must be proportioned with due regard to the strength of the possible earth current. The smallest cross-section in electric-generating stations is to be 0.248 sq. in. (16 sq. mm), and 0.0062 sq. in. (4 sq. mm) elsewhere; generally for copper conductors 0.00155 sq. in. (1 sq mm) for every 10 amperes may be reckoned. Cells in battery rooms must be so arranged that the attendant cannot simultaneously touch two points between which the difference of potential exceeds 250 volts. The nominal working current and pressure should be marked on switches. The author expresses strong approval of this rule, and also of the following: Plugs for the connection of movable conductors must be so constructed that they do not fit sockets made for a higher current. The normal rated current and pressure should be marked on the socket and on the plug. In the discussion which followed it was pointed out that with metallic-filament lamps the voltage variation possible is greater than with carbon lamps; the permissible drop of pressure should also, therefore, be greater. The German rules are in force in practice, but it is not so with the English Institution rules. It was greatly deplored that there should be so many sets of rules in England and it was thought that only one set should be recognized. If possible, international sets should be adopted.—Lond. *Elec. Eng'ing*, March 26.

Switchboard.—The first part of an illustrated detailed description of the 3200-volt switchboard at Hull. The present plant of approximately 6000 kilowatts is being extended with additional plant to an aggregate rating of 7000 kilowatts. A Ferranti cellular switchboard is used.—Lond. *Elec.*, April 3.

Wires, Wiring and Conduits.

Cell Switches.—F. Steindl.—An illustrated article giving wiring calculations for cell switches.—*Elek. u. Masch.* (Vienna), Feb. 16.

Overhead Construction.—Illustrations showing details of the construction of the 11,000-volt overhead line used by the Clyde Valley Electric Power Company.—Lond. *Elec. Eng'ing*, March 12.

Electrophysics and Magnetism.

Law of Electromagnetic Induction.—A long editorial with reference to C. Hering's recent paper. It is pointed out that in certain cases the idea of variation of flux is not applicable. For example, in the well-known case where a bar electromagnet forms part of the circuit, and a conductor, capable of rotation about the axis of the magnet, makes contact at one extremity with the pole and at the other end with the center of the magnet by means of mercury cups; a rotation of the conductor round the magnet gives rise to an e.m.f. Students often find a difficulty in understanding such a case because there is no change in the flux; there is, however, a continuous cutting of lines. With reference to the crucial experiment described in Hering's paper it is pointed out that variation of the current path in the iron will not cause an e.m.f., otherwise in the case of a conductor rotating round the pole of a magnet, referred to above, there would be no resultant e.m.f. in the circuit at all. The flux in the magnet may be regarded as practically linked in a circuit of its own, and the conditions would be the same if actually a brass band were put round the leg of the magnet over which the loop would be drawn in snapping it off. In following out this process it is at once seen that lines of force

do not cut any part of the circuit, and the current need not traverse the iron. It is thought that the rule of the cutting of lines is the fundamental statement of the law of induction.—Lond. *Elec.*, April 3.

Electric Discharges Through Gases.—J. J. Thomson.—An account of his third Royal Institution lecture on this subject. The author demonstrated the difference between the electrical conductivities of metals which obey Ohm's law and of gases where this law holds only for small values of the potential difference. In discussing the nature of the charged particles in gases he showed that it is possible to estimate their size from the speed with which they move through the gas. P. Phillips has found the following velocities in centimeters per second at a pressure of one atmosphere for the two ions under a force of one volt per cm: Hydrogen + 67, —7.95 cm; helium + 5, —6.3; oxygen + 1.36, —1.8; CO_2 + 0.76, —0.81; acetone + 0.37, —0.34; aldehyde + 0.30, —0.28, etc. In light gases the positive ions travel more slowly, while in the complex molecules (acetone, etc.) the two ions have practically the same mobility, or the positive are rather faster. The kinetic theory of gases enables one to calculate from these velocities that these particles consist of aggregates of more than one molecule, but not, as a rule, of more than three or four molecules, and we can imagine that those molecules are condensed about the charged particles, of which there will hardly be more than one in a million molecules. As the negative particles travel faster than the positive ones in *H, O, N,* etc., we should be able to charge a metallic tube electrically simply by sucking air through it, as the negative particles first reach the wall. This was shown with a brass tube, about 1 cm in diameter, nearly 1 m in length, with the aid of a Wilson electroscope, which was connected to the outside of the tube; the effect was very slight. The difference in the mobilities of the particles of opposite signs is very much greater at higher temperatures and at reduced pressure.—Lond. *Elec.*, March 27.

Lines of Force.—F. Sanford.—An article discussing the physical meaning of Faraday's lines of force in electrical theories. The author thinks that as long as electrical phenomena are explained by attractions between positive and negative charges, either the notion of action at a distance must be revived or some kind of a physical line of force must be assumed as attached at its ends to these charges and by its contraction pulling them together. If, on the other hand, electric phenomena may be explained by repulsions due to a pressure exerted by the electrons upon the surrounding ether, no physical lines of force are necessary, and no properties but those required by the elastic solid theory of light need be attributed to the ether.—*Phys. Rev.*, April.

Representation of Alternating-Current Phenomena.—D. W. Rennie.—After a note on the difficulty of graphical representation of alternating-current phenomena in the case of non-sinusoidal wave forms, two analytical methods are discussed, one of Perry and the other Steinmetz's symbolic method, which latter is said to be both convenient and flexible.—Lond. *Elec.*, April 3.

Electrochemistry and Batteries.

E.M.F. of Concentration Cells.—H. S. Carhart.—A mathematical paper giving a comparison of the formulas of Helmholtz and Nernst for the e.m.f. of concentration cells. The author maintains that Nernst's formula is exact only if the heat of dilution is zero, and in this case it is simply a conclusion from the second term of Helmholz's equation.—*Phys. Rev.*, March.

Electric Sterilization of Water.—An illustrated description of a commercial apparatus in which a brush discharge is produced between plates of glass covered with tinfoil by means of a small transformer. Air is drawn through between the plates and then thoroughly mixed with water. The apparatus is intended for house use for sterilizing drinking water.—Lond. *Elec. Eng'ing*, March 12.

Atmospheric Nitrogen.—Blondin.—A review of the work which has been done on the industrial fixation of atmospheric nitrogen.—*Bull. Soc. Int. des Elec.*, January.

Units, Measurements and Instruments.

Artificial Load for Testing.—R. K. Morcom and D. K. Morris.—An illustrated paper read before the Birmingham section of the (Brit.) Inst. Elec. Eng. The authors first give details of construction of water resistors. For inductive loads they recommend choking coils without air-gaps, the iron being worked at a flux density so high that the magnetizing current is correspondingly large. This construction has the advantage that the flux density can be increased four-fold, the leaking is very small, and the coil is exceedingly compact for a given load. On account of the high flux density it is important to use the thinnest laminations and to reduce hysteresis by employing the best iron. Artificial cooling is essential. The whole coil and winding may be immersed in water kept in circulation and slowly flowing to waste, or the limbs of the iron core may be surrounded by coils of flat copper tube, in which water is continually flowing. Where the voltage permits it, there is great advantage in the first method, which allows of the use of very high flux densities in the winding. Copper for the windings may even be dispensed with altogether, and the coil wound with iron strip worked at current densities which would be high even for copper if not specially cooled. Such coils are in the highest degree economical to construct and prove perfectly satisfactory if the e.m.f. of the generator to be tested does not exceed 2000 volts. While the coils work well over a wide range of current, their range of voltage is small. To provide a means of regulating the voltage they should be used in connection with a water resistor. The water resistor is arranged in such a manner that the inductive-coil current is shunted by an in-phase component of current in a water load, while, at the same time, resistance may be put in series with the choking coil. The arrangement is indicated in Fig. 2. In the vector diagram *A B* represents the total voltage to neutral; *A C* the voltage across the choking coil; *B C* the voltage

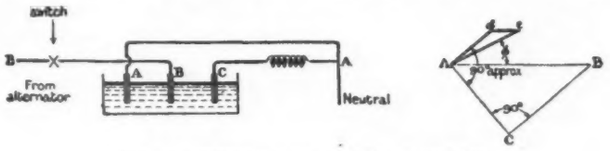


FIG. 2.—CIRCUIT AND VECTOR DIAGRAMS.

across the series resistance; *A d* the current in the choking coil and series resistance; *d e* the current in the shunt resistance, and *A e* the total current. By shifting the plate *B* toward *A* or *C*, the double adjustment may be conveniently effected at one time. Adjustment is also obtained by raising or lowering one or more of the plates. The inductive coil either may be immersed in the tank or may be in a separate place according to the method used. Further variations of voltage and current may be obtained by the well-known methods of paralleling the coils, or changing from star to mesh connection, or both, used always in conjunction with the above combination of water-loads.—Lond. *Elec. Rev.*, March 13.

British National Physical Laboratory.—An account of the work done in 1907 and of the work proposed for 1908. A large plant for life tests of lamps will be installed. The new laboratory for metallurgical chemistry and the new buildings for the engineering and meteorological departments have been completed. As to the work proposed in the physical department it is intended to obtain to a high order of accuracy the units of current and resistance in absolute measure, while experiments will also be made on such secondary standards as mercury tubes, standard cells and the silver voltameter. In lamp testing the question of color differences will be investigated. The progress of the research on the Violle standard recommended by the International Photometric Commission at Zurich will depend chiefly on the success of Harker's experiments on large refractory furnaces. Work in the thermometry division will include a comparison of thermocouples and the equipment of a new laboratory for high-temperature work. During 1907 a very complete comparison of the mercury, platinum-silver and manganine resistors has been made. The

results show that with one exception the relative resistances of the mercury tubes have kept wonderfully constant. Some of the older platinum-silver standards showed considerable changes, while manganin coils have generally remained more constant. In the photometrical section every effort has been made to reproduce the value of the pentane standard in electrical sub-standards which have been set up for reference; this is done by means of 10 large-bulb Fleming-Ediswan laboratory standards. In the electrotechnical division considerable experience has been gained in the use of the quadrant electrometer for absolute measurement of electric power, while tests were also made to discover whether the readings of a 600-ampere Kelvin balance were independent of frequency changes. It was found that the readings of the balance exactly agreed with the calculated values, showing its independence in this respect.—Lond. *Elec.*, March 27.

Standards.—R. T. Glazebrook.—The first of two lectures on standardization in various aspects. In the present lecture the mechanical side of the subject was discussed. The author dealt with the standards of length and weight, and described methods most in use for comparing the length of a certain bar with that of the standard. He also referred to the work of the Engineering Standards Committee on limit gages and on some work done at the National Physical Laboratory.—Lond. *Elec.*, March 27.

Induction Between Parallel Wires.—E. Orlich.—The author gives the mathematical definition of what he calls the "mean geometrical distance" and shows how to apply this conception to the calculation of the self-inductance of long, straight wires. He then deals with the self-inductance of loops and describes an arrangement of measurements which enables one to find the inductance of a single conductor according to its mathematical definition.—*Elek. Zeit.*, March 19.

Barretter.—K. E. F. Schmidt.—A note on some experiments made with a barretter. The barretter studied was of the original thermal type in which an extremely fine wire has its temperature and, therefore, its resistance, altered by the passage of the current from the aerial. The behavior of barretters having wires with diameters from 0.02 mm to 0.01 mm at different temperatures and carrying different currents was studied, and curves were obtained showing their properties. With barretters standardized in this manner measurements were made which proved that an atmosphere of hydrogen greatly increases the constancy of the oscillations produced by a spark. It was shown that the sensibility of the barretter increases with its resistance, and that the finest possible wires should, therefore, be used. The total resistance of the Wheatstone bridge should be as low as possible. The sensibility does not change appreciably with variations of the external temperature within ordinary limits.—Lond. *Elec.*, March 27.

Thermoelectric Couple.—Pecheux.—An account of experiments with a platinum platinum-iridium couple for high temperature measurements. The results of experiments are given which show that with a commercial pyrometer of this type one may measure temperatures up to 600 deg. C. with an exactness of 3 deg. and in the interval from 600 to 1400 deg. with an exactness of 6 deg.—*La Lumière Elec.*, March 7.

Telegraphy, Telephony and Signals.

Transatlantic Wireless Telegraphy.—Marconi.—A Royal Institution lecture on the history of over-sea wireless telegraphy, beginning with the attempts in 1899 to establish communication between England and France, and leading up to the experiments made in 1907 between Clifden and Glace Bay. Two chief features of the latter were the employment of the directional aerial (using the horizontal antenna disposed in a particular manner) and the employment of air condensers to reduce the losses due to dielectric hysteresis and breakages in the dielectric. The wave length used during these tests was 12,000 ft., the capacity 1.6 microfarads and the potential to which the condenser was charged 80,000 volts. Long-distance wireless stations are now being erected in various parts of the world, the most powerful being that at Coltano, owned by the Italian government. Marconi is of the opinion that "telegraphy through space will soon be in a position to afford communication at a cheaper rate than is possible with cables."—Lond. *Elec.*, March 20.

Wireless Telegraphy.—A note on the Poulsen wireless telegraphy station situated at Lyngby, near Copenhagen, which was enlarged last summer, the height of the aerial being increased. This station is in communication with Newcastle, Berlin and St. Petersburg. The generating plant consists of a gasoline engine coupled to a 10-kw dynamo, which supplies energy to a single arc-gap. To supply the inert gas, with which the arc is surrounded, a few drops of alcohol are introduced into the arc-chamber every second. This renders the use of a complicated hydrogen generator unnecessary.—Lond. *Elec. Eng'ing*, March 26.

Wireless Telegraphy.—R. Rüdenburg.—An account of a laboratory investigation into the conditions under which electric waves used in wireless telegraphy are absorbed. His results emphasize the hopelessness of transmitting energy by wireless means in a quantitative manner. The dissipation is enormous even in the best systems. The amount of energy absorbed from a given wave is proportional to the square of its wave length, so that there is a rapid increase of efficiency on lengthening the waves. On the other hand, the somewhat surprising conclusion is arrived at that the effective length of the antenna is without any influence upon the proportion of energy absorbed. This, however, appears not to apply rigidly to a single vertical antenna. It does apply to the "umbrella" form of receiving antenna, whose effective length is about half the height, since downward currents along the ribs reduce the radiation from the vertical wire. The author gives some diagrams illustrating the distortion of the wave-train by a receiving antenna. This distortion extends over about 24 wave-lengths. The area from which energy is absorbed has a radius equal to about one-fifth of the wave-length.—*Annalen d. Phys.*, No. 3; abstracted in Lond. *Elec. Eng'ing*, March 26.

Electrolytic Detector.—H. Abraham.—A note on an experimental investigation of the influence of temperature on the constants of an electrolytic detector. The operation of an electrolytic detector appears to depend on two quantities: (1) Its capacity for polarization in the immediate neighborhood of the standard polarization under which it is used, and (2) its internal ohmic resistance in series with the polarization capacity. These quantities have been measured by means of an alternating-current galvanometer for frequencies of 500, and with which the amplitude and phase of the current can easily be determined. The capacity is of the order of hundredths of a microfarad, and the internal resistance is several thousand ohms for sensitive detectors, such as are used in wireless telegraphy. Detectors with larger wire, which are less sensitive, have a higher capacity and a lower resistance; the variation of these quantities is less rapid than the variation of free surface of electrode. When the detectors are heated to 120 deg., their resistance is reduced to some hundreds of ohms, and their capacity rises to about half a microfarad. This increase does not, however, have any harmful effect on the sensibility. Their low internal resistance allows for the same sensitiveness, better tuning and a more perfect syntony with the vibratory circuit and the exciting waves.—From *Bull. Soc. Franc. de Phys.*; abstracted in Lond. *Elec.*, March 20.

Magnetic Detector.—A. G. Rossi.—A description of an instrument based upon Sella's "magneto-elastic principle." It consists of an iron or nickel wire in a magnetic field traversed by an alternating current and subjected to simultaneous tension and magnetic torsion. Incident wave-trains reduce the amplitude of the torsion and shorten the track of the spot of light cast by a smaller mirror attached to the wire. This circumstance paves the way for direct photographic registration. The wire has a diameter of 0.1 mm and a length of 20 cm. Two bar-magnets, each 10 cm long, are mounted parallel to the wire, near its ends. The magnets are weak, and the alternating current very feeble. The torsional vibrations of the wire are tuned to the incident wave frequency. The wire from the antenna is brought to the center of the stretched wire without touching it, and winds round it in two opposite coils. The main

advantage of the new detector lies in the small mass—about 15 milligrams—which prevents any transformation of the energy into undesirable forms, such as takes place in Marconi's magnetic detector.—*Nuovo Cimento,* January; abstracted in Lond. *Elec. Eng'ing,* March 26.

Wireless Photography.—A note on experiments made by J. Rieder with apparatus by which wireless photography is said to be obtained. A glass plate was spread with shellac solution and sprinkled with aluminum powder. This, before it was dry, was brought into contact with a highly sensitive photographic plate which was protected from light waves. When this system was exposed to electric waves a distinct representation was observed on the plate after development. It has further been found that the metal powder at the places of strongest exposure showed the smallest density of aggregation, in opposition to what might have been expected. It was not found necessary to de-cohere by shocks before submitting the apparatus to a new experiment. Researches show that specially prepared plates of this description were sensitive to electric waves at distances of about 250 yards. Rieder is at present conducting further experiments in this direction.—Lond. *Elec.,* March 27.

Loaded Telephone Cable.—A brief note on an attempt made by W. C. Jaetmann to increase the self-induction of telephone cables by using an "electrolytic" sheath of iron over the copper wire. This method intends to increase the self-induction of the cable uniformly all along its length and, therefore, differs from the method of Pupin, who loads the cable with inductance coils at certain intervals.—Lond. *Elec.,* March 27.

Vienna.—The first part of a long illustrated article on the new imperial telegraph station in Vienna.—*Elek. u. Masch.* (Vienna), March 22.

Miscellaneous.

Effect of Electricity on Plants.—J. H. Priestley.—A paper read before the Naturalists' Society, giving a long account of the several attempts which have been made in various localities to apply electricity as a stimulus to plant growth. The author deals especially with the successful experiments made on a large scale by J. E. Newman, who used two different systems, one being an overhead discharge system, wires being spanned over the area to be treated and charged by means of an influence machine; the second system using plates of different metals sunk in the ground and connected by a wire.—Lond. *Elec. Eng'ing,* March 26.

BOOK REVIEWS.

Eliktrische Centralen. By K. Wilkens. Leipzig: S. Herzel. 350 pages; 158 illustrations; 16 plates. Price, 28 marks.

Central-station equipments from the prime-movers to the network of conductors are fully described in the present volume. There are seven chapters, the first of which is devoted to historical matter. The second chapter deals with the distributing circuits. In the third chapter, the economical features of the whole system are treated. The characteristics of the various prime-movers are compared in Chapter 4; this chapter also contains discussions of direct-current and alternating-current generators and substation apparatus. The remaining three chapters are devoted to the general operating features of central stations. The treatment is characterized by thoroughness, the discussion of testing apparatus and methods being particularly good.

Transformatoren und Asynchronmotoren. By W. Winkelmann. Hannover: Max Jaenecke. 136 pages, 79 illustrations. Price, 4.2 marks.

Since the author combines in one volume the treatments of the stationary transformer and the induction motor, it is natural that he should select a method of presenting the features of the transformer which can also be used with induction motors and should consider the induction motor largely from the standpoint of its resemblance to the stationary transformer. He has resorted to the graphical method of representing the phenomena of these devices and has succeeded in producing a book that possesses the element of simplicity to a marked degree. Information is given concerning the operating characteristics and design features of single-phase transformers and auto-transformers, and the combined core and shell type three-phase transformer. The treatment of the performance of induction motors is somewhat too brief to be satisfactory, but the elements of design of this machine are fully covered. The author closes with a short discussion of the use of induction motors as generators, and the excitation and compounding of these machines. The book is well suited to the needs of the designer of the electric and magnetic circuits of transformers and induction motors; mechanical details and insulation data are almost ignored.

Vorlesungen uber die Vektorenrechnung. By E. Jahnke. Leipzig: B. G. Teubner. 235 pages; 32 illustrations. Price, 5.6 marks.

Although this book deals almost exclusively with mathematics and just enough with physics to show that the mathematics is capable of practical application, yet it is not wholly without interest for electrical engineers. Probably no branch of mathematics is used more frequently by electrical engineers than that involving the vector representation of alternating quantities. It is this branch that the present volume covers. However, the treatment employed by the author is one that will appeal more strongly to the mathematical physicist than to the engineer. The first six chapters are devoted to vectors in a single plane, and the last twelve treat of vectors in space; the former are directly applicable to the ordinary single-frequency quantities, while the latter must be used when quantities of several frequencies are to be dealt with. It is customary either to neglect the vector-displacing effect of higher harmonics in alternating-current problems or to calculate the real effect without assigning a position in space to each vector, but for absolute accuracy certain of the vectors should be represented in the third dimension, certain in the fourth, etc. To those who wish to reach this higher degree of accuracy, the book will prove instructive and valuable.

Physikalische Grundlagen der Gleich- und Wechselstromtechnik. By A. Koenigswerther. Hannover: Max Jaenecke. 119 pages; 74 illustrations. Price, 2.6 marks.

In the present volume the electrophysics of direct and alternating current is treated from the standpoint of an electrical engineer rather than of a physicist. The subjects dealt with are those usually treated in purely physical text-books, but special emphasis is laid on the relations that are applied in engineering practice. Moreover, alternating-current phenomena are discussed at some length. The book is intended as an introduction to the study of direct current- and alternating-current machinery and it is well arranged for this purpose.

Synchronmaschinen für Weckselstrom und Drehstrom. By W. Winkelmann. Hannover: Max Jaenecke. 148 pages, 79 illustrations. Price, 3.4 marks.

The design, construction and operation of single-phase and polyphase synchronous generators, motors and converters are treated in this little volume, but the major portion of the book is devoted to the calculation of the magnetic and electric circuits of these machines. Some little use has been made of graphical diagrams, and a few equations are employed, but it can almost be said that the mathematical part of the work has been reduced to arithmetic by the use of machine constants for the symbols in the algebraic expressions. In some instances calculus is employed, but the treatment is not based on a mathematical foundation. Although many hints are given as to design features, these hints are largely incidental and are merely one of the elements in the author's method of presenting the theory by applying it to actual machines. The book can be read with profit by both the electrical engineering student and the designer of synchronous machines.

THE UNIVERSAL ELECTRICAL DIRECTORY FOR 1908. London: H. Alabaster, Gatehouse & Company. 1500 pages.

This year's Universal Electrical Directory contains more information and data than ever. A new feature of value is that of giving details as to nature of current, voltage, etc., of the electricity plants enumerated in Great Britain and in the Colonies, etc. The preface speaks hopefully of the general situation in England after a rather prolonged period of depression.

THE INSULATION OF ELECTRIC MACHINES. By Turner & Hobart. New York: The Macmillan Company. 297 pages, 145 illustrations. Price, $4.50.

This work presents a comprehensive study of the applications of insulating materials in the construction of heavy electrical apparatus, and as the pioneer in this field it will be welcomed by those who appreciate the need and the lack of complete and reliable information on the subject. That the field is by no means completely covered is clearly realized by the authors, who state in the preface (and it cannot be too much emphasized) that: "Probably no other properties of any materials employed by engineers are so indefinite as these, and it is essential for anyone, on taking up the subject, to disabuse his mind of the idea that a high degree of accuracy is at the present time attainable."

The book consists mainly of a compilation of the most important papers on the subject that have appeared in recent years in the publications of the electrical societies and in the technical press, both here and abroad, supplemented by copious extracts from trade circulars and by the results of the authors' personal investigations and large practical experience. It is to be regretted that the data from the authors' own work is not more extensive, as it forms one of the most valuable portions of the book—limited as it is.

The opening chapters state the requirements to be fulfilled by insulating materials, describe several forms of high-voltage testing sets used in investigations of dielectric strength, and give typical results of tests, with theoretical explanations of some of the phenomena observed. These chapters, as well as many others, are marred by long extracts from trade publications. Later chapters cover "Some Properties of Insulating Materials," being mostly results of investigations by Steinmetz, Holitscher, Walter, Baur, and others, which have been published elsewhere; also the "Insulation of Magnet Wires," with many good tables, and "Mica and Mica Compounds." The various styles of molded composition are next taken up, the greater part of the data furnished being supplied by the makers, while a chapter on varnishes, oils and impregnated cloths and fibers contains much information of a practical nature. Special chapters are devoted to commutator and field-coil insulation. A good deal of attention is given to the grouping of armature conductors in the slots, and to the "space-factor" or ratio of the copper to the total cross-section, but the actual data on these subjects is disappointing. Transformer insulation is very inadequately treated in 10 pages, devoted largely to oil, practically nothing being given on high-voltage designs. In fact the book scarcely treats at all of high-voltage work, being devoted mainly to low-voltage direct-current apparatus. The remaining chapters are descriptive of factory processes for the manufacture and application of insulating materials, with a final chapter on specifications for insulation. There is added a very complete index and bibliography.

The make-up of the book is poor. In particular, the illustrations are neither well selected nor executed, being crude wood-cuts or half-tones. Many curve sheets are given which appear to be reproductions of hand-lettered sheets and present a most untidy appearance. The metric system is used, but sometimes in combination with pence and pounds—a weird mixture of units. Much attention is given to methods of testing for dielectric strength, particularly to Dr. Walter's so-called "Picein-drop" method, a highly specialized but not very practical scheme, using an induction coil discharge and tending to show a puncture voltage proportional to thickness. Many tables and curves are given representing the dielectric strength of a great variety of materials, prepared and tested in various ways. The work gives results from many investigators using different methods, and there is little attempt at standardization of system; nevertheless it is of value for its suggestiveness, and as giving an introduction to the subject, a first approximation to the magnitudes involved and a general idea of the materials and methods employed for machine insulation

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INDUCTIONSMOTORS FÜR EINPHASEN-WECHSELSTROM. By R. von Koch. Berlin: Julius Springer. 102 pages; 49 illustrations. Price, 2.6 marks.

The title might lead one to believe that this book is devoted exclusively to the machine known in this country as the single-phase induction motor. The author, however, has included the so-called "repulsion" motors and the combined repulsion and induction motors, probably because he considers all of these machines to be induction motors. The treatment is confined largely to a discussion of the performance characteristics of the various machines, and a comparison of the different types. In an appendix the design features of a certain 3-hp, 50-cycle, single-phase induction motor are analyzed. For this purpose use is made of the simple circular current locus, after the value for the magnetizing current has been calculated and the leakage coefficient has been assumed. The book furnishes a fair outline of the several motors, but the treatment is too brief to give depth to the extensive ground which the author attempts to cover.

WECHSELSTROMKURVES. By Dr. Ernst Orlich. Braunschweig: Freidrich Vieweg & Son. 117 pages, 71 illustrations. Price, 3.5 marks.

The whole of this little volume is devoted to explaining the devices that are in use for observing the e.m.f. and current curves in alternating systems and the various methods that have been proposed for analyzing the curves into their several components. The devices described include those of Joubert, Franke, Hospitalier, Rosa and Callendar, Goldschmidt and Ryan, Braun, Gehrcke, Blondel, Abraham, Kaufmann, Townsend, and Kühns, in addition to electrochemical and optical apparatus. Among the methods for analyzing the curves are mentioned those of Des Condres, Langsdorf, Clifford, Houston and Kennelly, and Fischer-Hinnen. Descriptions are included of the mechanical analyzing devices of Kelvin, Henrici and Coradi, Sharp, Yule and Le Conte, Wiechert and Sommerfeld, Michelson and Stratton, and of Terada. Each of the above devices and methods is fully explained.

DAS PROBLEM DER SCHWINGUNGSERZEUGUNG. By Dr. H. Barkhausen. Liepsig: S. Hirzel. 112 pages, 47 illustrations. Price, 4 marks.

The general subject of the production of oscillations is considered in this little treatise, from the standpoints both of mechanics and of electromagnetics. The parallelism of the phenomena under the two sets of conditions is clearly brought out in such a manner as to enable the student to grasp each the more firmly by the analogy presented in the other. The treatment is mathematical and technical, from the point of view of a technologist rather than from that of a physicist. The volume is well adapted for use as a text-book in connection with applied mechanics on the one hand, or applied physics in electrical engineering. It is of lesser interest to the practising electrical engineer.

LES DÉCOUVERTES MODERNES EN PHYSIQUE. By O. Manville. Paris: A. Hermann. 182 pages; 32 illustrations. Price, 5 francs.

In the space of 180 octavo pages the author gives a clear exposition of the leading facts and the current theories of the "new" physics, i. e., the physics of the ion, the electron and the emanations. It is written for the qualified student who has prepared himself by a suitable equipment of the calculus and

the mechanics of energy. It makes no pretence to originality of treatment or of thought, being in the main a résumé of the standard works recently written on the subject. Nor is there any insistence on the theories advanced and defended by English and German physicists. The writer's aim is mainly to familiarize his countrymen with the phenomena of radio-activity and then to leave it to their individual judgment whether or not to accept the revolutionary hypothesis put forward abroad for their explanation.

We note that he writes *catode* and its derivatives where other French authors conforming to the Greek write *cathode* or *kathode*. The following are instances of careless writing: Marc-Clelland, p. 55, for McClelland; Towsend, p. 85, for Townsend; Ruterford, p. 136, for Rutherford; æther et matter, p. 116.

MITTEILUNGEN ÜBER FORSCHUNGSARBEITEN. Berlin: Julius Springer. 152 pages; illustrated.

This number of the well-known German technical series contains important descriptions of three very interesting researches, namely, on the efflux of hot water, on the heating of electrical machines, and on the relation of the specific heat of steam to pressure and temperature. All of these researches were conducted in the physico-technical laboratory of the Technological High School of Munich. They represent collectively a large amount of careful work. It is to be regretted that no machinery exists for bringing German- and English-speaking engineers into closer mutual contact on researches of this character.

Edison Batteries in Automobile Service.

There are many features of the Edison battery that render it especially well suited for vehicle duty. Its total weight is only about .09 lb. per watt-hour or its output is 11 watt-hours per lb. It is mechanically so strong that its life is not decreased by the rough usage to which automobile work subjects it. A life of two years is now assured in average vehicle duty. Moreover, the electrolyte, consisting of a potash solution, is entirely without odor and does not develop objectionable vapors during the charging or discharging period.

FIGS. 1, 2 AND 3.—EDISON STORAGE BATTERY.

For use with automobiles the cells are arranged in sets of 7 or 8 in wooden trays. A tray with 8 cells weighs only 160 lb., so that it can easily be carried by two persons, and hence the battery can be removed readily. The cells correspond almost entirely in their mechanical design and as regards the active electro-chemical material with those exhibited at St. Louis at the World's Fair. The appearance of the plates and of the plate body held together by means of pole bolts and edge frame, the external form of the cells and of the pole terminals, the filling, opening and safety valves are clearly shown in Figs. 1, 2 and 3. An apparatus has been designed for re-filling the cells with distilled water, the bell of which rings as soon as the cells have been sufficiently filled.

The above described batteries are built by the Deutsche Edison Akkumulatoren Company, Berlin, Germany, and are used in the automobiles of the Bergmann Electrical Works, of Berlin. A view of a bare chassis, showing the way in which the battery has been fitted under the front and rear seats of a pleasure automobile without taking up an excessive amount of room, is given in Fig. 4, while Fig. 5 shows the complete vehicle arranged as a Victoria. For an automobile of this type capable of taking four persons inside and two on the box, the battery consists of 64 cells having a rating of 14 kw-hours and weighing 1270 lb. Such a vehicle can run 56 miles on one charge on level roads at a speed of 16 miles per hour. A single 5-hp geared motor acts on the rear wheels through

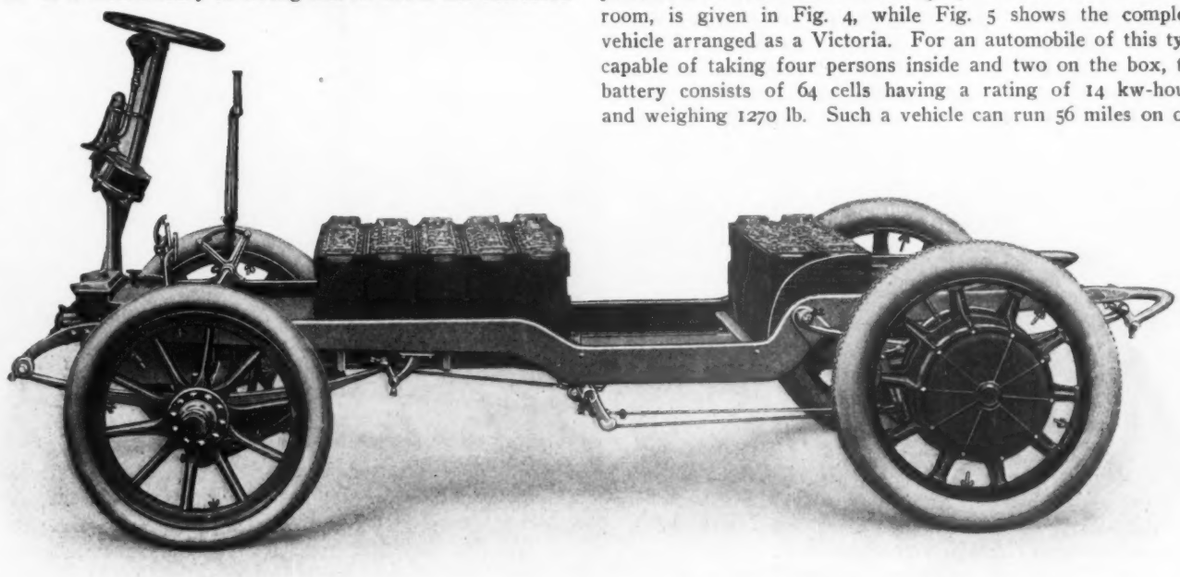


FIG. 4.—BARE CHASSIS WITH BATTERIES IN PLACE.

differential mechanism. Noiseless running is obtained by the use of spur gearing provided with angular teeth.

The Bergmann Electrical Works use the Edison battery also in delivery trucks. A 2-ton truck equipped with a 64-cell battery having a rating of 14 kw-hours can be run fully loaded at a speed of about 7.5 miles per hour. On one charge this car can cover a distance of about 37 miles, which suffices in the majority of cases.

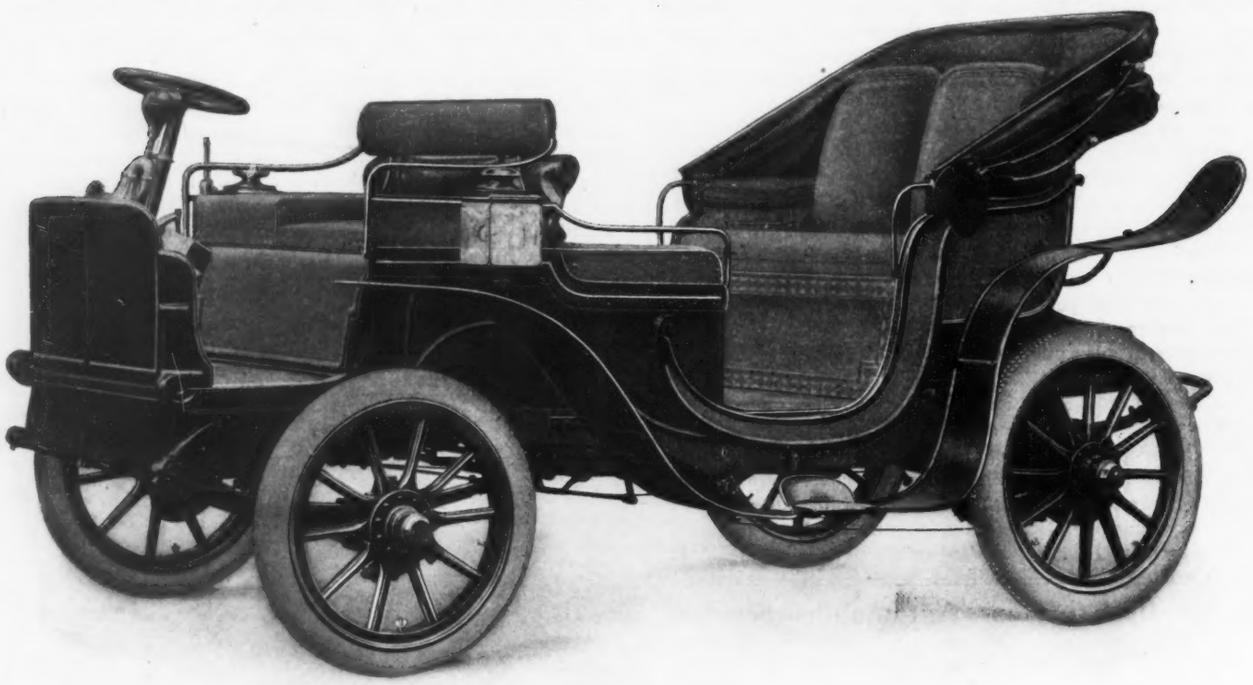


FIG. 5.—COMPLETE ELECTRIC VICTORIA.

New Asbestos Insulating Material.

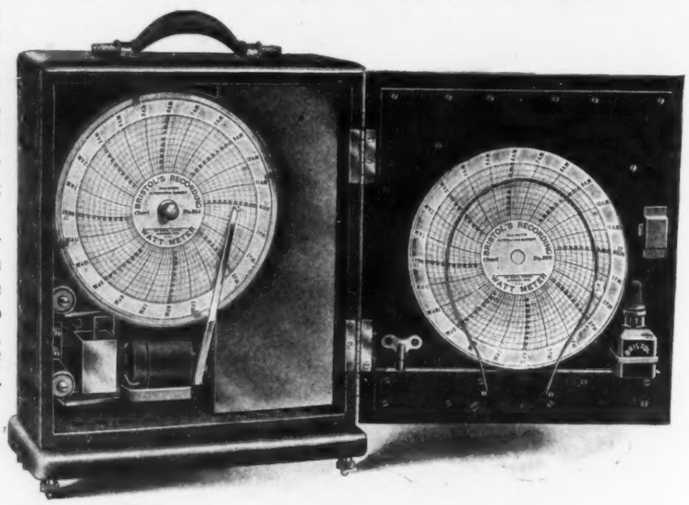
Asbestos wood, the invention of Prof. C. L. Norton, and marketed by the H. W. Johns-Manville Co., is being introduced as an electrical and fireproof insulating material. Many advantages are claimed for it over marble, slate, fibre and wood, for switchboards, switch bases, insulating pieces, etc., as well as for general fireproof construction. It is easily worked with wood-working tools and can be sawed, nailed or screwed the same as hard wood lumber. It is absolutely fireproof, making it especially desirable for all construction where there is danger of short circuits.

One of the many applications of asbestos wood is in the construction of doors in front of high-voltage stations, where an absolutely fire-proof and insulating material is essential. The insulation resistance is extremely high, being almost equal to that of sheet mica, which is the best insulating material known. Asbestos wood has a smooth surface and will take any kind of finish that may be desired. For electrical purposes it is regularly furnished in ebony finish.

Portable Recording Wattmeter.

The recording wattmeter shown herewith has recently been brought out by the Bristol Company. It will be observed that the electrical elements consist of a narrow coil (to the left), which is wound with fine wire and mounted on vertical spring supports so as to be capable of motion toward the wide stationary coil (to the right), which carries the total current to be measured. The pressure coil is wired in series with an auxiliary resistance mounted behind aluminum partitions, shown to the right behind the dial. When this coil is connected across the line, the magnetic effect is proportional to the voltage, while the magnetic effect of the low-resistance current coil will depend upon the current. The mutual attraction of the coils will then be the product of these magnetic forces, and the resulting motion of the pressure coil toward the stationary one is, therefore, proportional to the watts. Since the pen arm is attached to the right-hand support of the moving coil, it multiplies the motion and a record is made on a uniformly revolving chart. The design is such as to eliminate permanent magnets, jewel bearings, shunts, relays or other complexities.

The case is made of wood, conveniently provided with a leather handle and lifting screws. Provision is made to carry charts, ink and the clock key, as shown, so that the operator



PORTABLE RECORDING WATTMETER.

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The meter is made in all capacities for direct current to 200 amperes and 650 volts. For single-phase alternating current it is operated without transformers for light currents at low voltage; but any current and voltage can be recorded by simply operating the wattmeters from small transformers of the proper ratios. For three-phase alternating currents the current coil is operated in series with one phase, or from the secondary of a current transformer, while the voltage coil is wired in star through two resistances.

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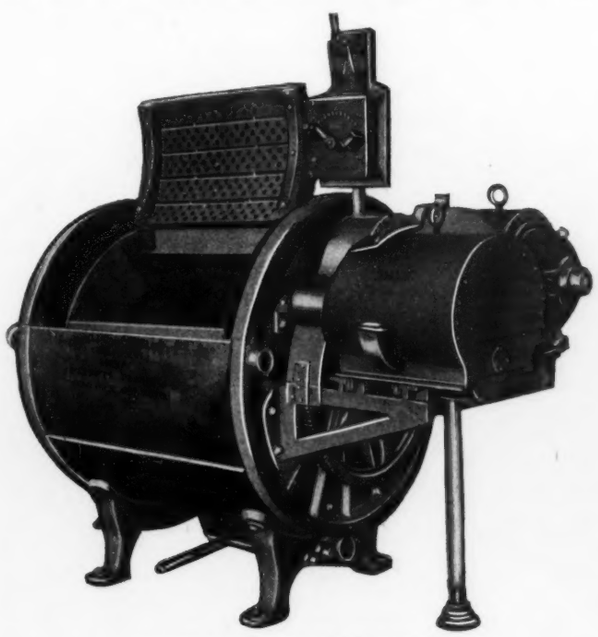
Motor-Driven Washing Machine.

The attitude which is being assumed by leading manufacturers of machinery of various types in regard to electric motor drive, shows that this form of drive is rapidly gaining ground and that the standard machine of the near future will be a unit including the motor. The case of the Conkling laundry washer, shown in the accompanying illustration, may be taken as an example. The principal feature of this machine is the automatic reversing mechanism, so arranged that the inside cylinder makes equal revolutions each way. This mechanism did away with the double-belt arrangement otherwise required for reversing, and required but one belt from the shafting. When it came to attaching an electric motor, the original arrangement consisted of a frame extending across the top of the machine. The motor was secured to the middle of this frame and provided with a long shaft, driving a pulley in line with the pulley on the reversing mechanism and connected by a belt. As the demand for motor-driven machines increased, a more compact and satisfactory arrangement was sought. The result of the efforts of the Conkling Company's engineers is shown in Fig. 1, where the motor rests in a position directly behind the reversing mechanism and is geared directly to it. Westinghouse motors were selected for both methods.



MOTOR-DRIVEN WASHING-MACHINE.

The improved arrangement has many advantages over the old, and makes the unit one of the most satisfactory machines in the equipment of the modern laundry. By doing away with the belts, and gearing the motor directly to the reversing mechanism, a more compact and substantial outfit is provided. The use of belts about laundries is always attendant with more or less dirt and oil, which compels some rewashing. By using gears which are entirely enclosed, there is no possibility of the clothes becoming soiled from the machine.

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This device is a modification of one of the forms of polyphase wattmeters made by the same company, with both electrical elements acting on the top disk and a strong damping system acting upon the lower disk to provide the necessary time lag. In place of the usual register there is provided a single graduated dial and two pointers. One of these is driven by the moving element through a train of gears and indicates at any instant the power passing through the device. The other pointer is driven by the first and remains at the maximum position reached by it, being held in this position by a ratchet. The final position reached by this second pointer indicates the maximum power taken from the circuit. A thumb-nut is used to set the maximum-demand pointer back to zero, and may be sealed to prevent tampering by unauthorized persons.

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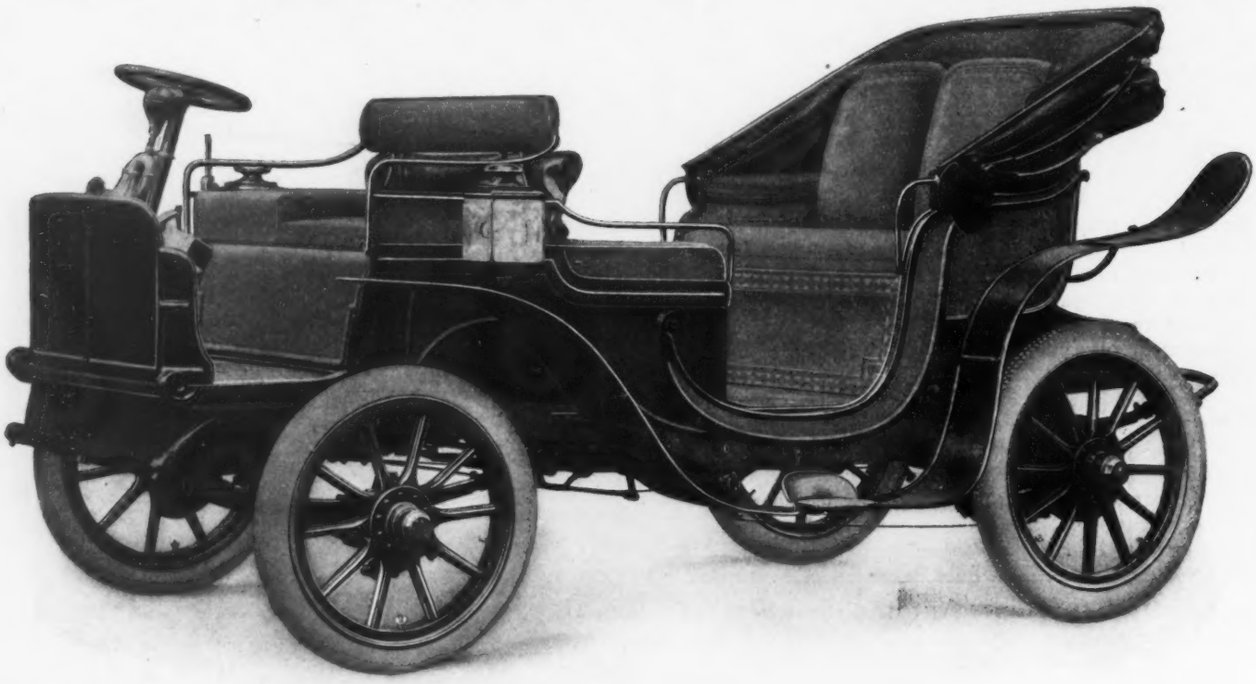

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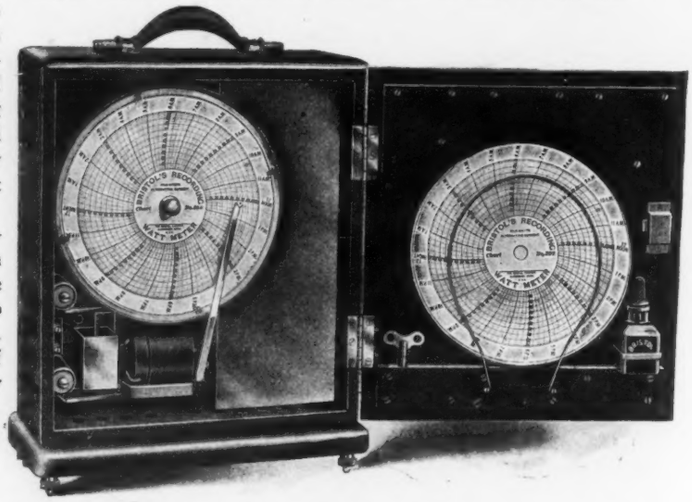

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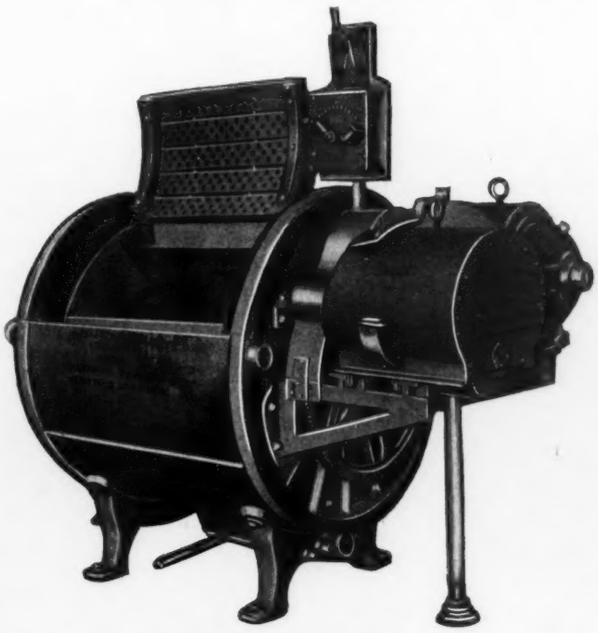

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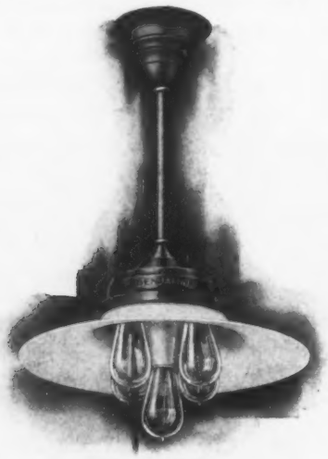
stem of ⅜-in. pipe and ¾-in. casing, crowfoot, wires, deep canopy, cluster body and 18-in. opal reflector. The brass base is provided with a conical-shaped, frosted-aluminum reflector which materially increases the reflecting surface of the device. The fixture is made for four, five or six lamps, with or without



TUNGSTEN LAMP FIXTURE.

a center lamp opening, and with or without a pendant switch. It is symmetrical in outline, pleasing in appearance and offers an effective, convenient and economical fixture for public lighting purposes.

New Type of Induction Motor.

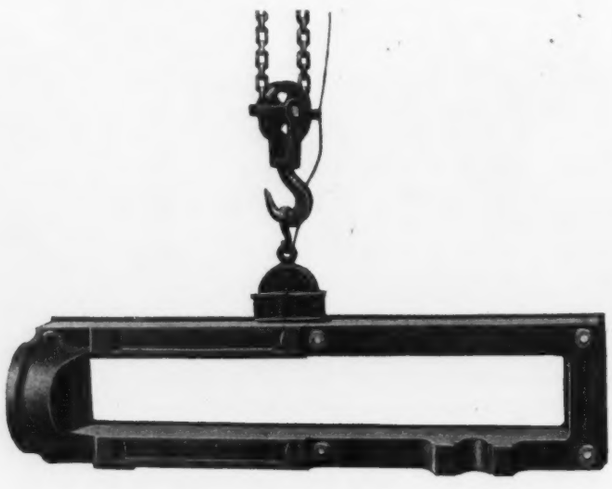
To meet the varying conditions imposed by high starting torque with low initial starting current, a modified form of motor has been produced by the Westinghouse Electric & Manufacturing Company, the general appearance of which is shown in the illustration. The frame of the motor is amply ventilated, but so constructed as to protect the laminations from injury. Throughout the motor has been designed for hard service. The insulation on the coils has been very thoroughly made so as to stand much greater stresses than it receives in normal service. It is, furthermore, so built that vibration and consequent wear of the insulation is prevented. A feature of the motor are the brushes by means of which connection is made to an external resistance. These bear on continuous rings of metal so that there is no occasion whatever for sparking. The brushes are liberally proportioned, that they may have long life and require a minimum of attention. The rotor is unlike the usual short-circuited type of armature on induction motors, and has a regular winding in which the resistance is inserted while starting, and thus the starting current is limited. Approximately full-load current is required to produce full-load starting torque. Special covers are provided for enclosing the brushes where this may be desired.

50-HP ALTERNATING-CURRENT MOTOR.

The motors are built in the usual sizes from five to 500 horsepower, and the standard frequencies are 25, 40 and 60 cycles In connection with these motors, special starting devices are supplied by which the current at starting is varied by hand In operation these starters cut resistance out of the circuit of the rotating armature until the handle reaches the full-on position, when the resistance is all short-circuited and the motor runs with practically the constant-speed characteristics of the squirrel-cage armatures. A special short-circuiting switch is provided on motors of 100 horse-power or larger, if desired. This relieves the brushes and the leads and contacts on the starter, as the windings are short-circuited inside the motor.

Electromagnets for Lifting Purposes.

Although electromagnets have been used for some time for lifting purposes, their possibilities are not always fully appreciated. The Sandycroft Foundry Company, of Chester, England, has made a special line of electromagnets for this work and many of them have found extensive use. The saving of time they effect is obvious, especially where a number of rough, heavy pieces of iron or castings require handling. The magnets are also useful in handling packed goods. Ordinarily when packing turned shafts for shipment the cases have to be made somewhat larger than necessary to allow of the slings being drawn, and in the case of heavy shafts and large slings this allowance would be considerable, all of which, with the packing pieces afterward required for steadying the shafts, is dead waste of material, and can be saved by the use of electromagnets. The illustration herewith shows a magnet weighing 84 lb. lifting a casting weighing 2000 lb., the current required being 1½ amperes at 110 volts. The pole faces can be modified to suit special requirements and different sections. The correct proportioning of the magnet has considerable influence on its lifting power, particularly when sections, such as channels, have to be handled.



LIFTING MAGNET.

Electricity in the Meat-Packing Industry.

Two of the many advantages of the electric motor over the steam engine in industrial establishments are economy and cleanliness. These two features have caused the former machine to replace the latter in many establishments where all other advantages were considered of secondary importance. An illustration of an industry in which the use of electric motors has been dictated so strongly by the demands for absolute cleanliness that all other features would have been ignored in order to obtain the desired results, is found in the meat-packing business. In place of the old system of shafting, belting, pulleys and gears innumerable, which formerly stretched in a network across each room, gathering dirt and waste on every exposed surface, there is now used the electric drive with clear headroom, free floor space, excellent light, ventilation and operating conditions. In addition to meeting the prime requirement for cleanliness, the electric equipment has proved more economical than the former equipment, and the output has been increased.

The extent to which motors are now utilized in the meat-curing industry, and their widely diversified application, are illustrated by the electric installations in the various Chicago plants of Swift & Company and Libbey, MacNeil & Libbey, where machines having a total rating of about 9000 horse-power, in units of from one horse-power up, are in daily operation.

Strange and queerly named apparatus, which the average man never heard of and probably would not understand, such as rockers, plotters, candles, crimpers, crutches, neutralizers, etc., are driven by motors on the same current as that supplied to others turning, shaking or agitating the mixtures in machines of homely but perfectly intelligible names, to wit: brainers, splitters, cleavers, skinners, strippers, carcass-conveyors, meat-hoists, metal sharpeners, rip-saws, horn saws, throw outs, etc., in the butcher-shop; rippers, cleaners, stuffers, roller-benches, washers, salters, brine-cooler pumps, fan-blowers, spice mills and mixers, sewing machines, etc., in the sausage plant; oil pumps, mixers, renovators, box churns, suet choppers, salt mills, butter-workers, etc., in the butterine factory; kettle-stirrers, cutters, hashers, presses, mills, oil circulators, molding machines, box mailers, etc., in the soap factory; bone saws, pulverizers, block presses, dryers, washers, compressers, guano crushers, screens, etc., in the fertilizer works; dryers, grinders, reels, etc., in the glue establishment; barrel-headers,

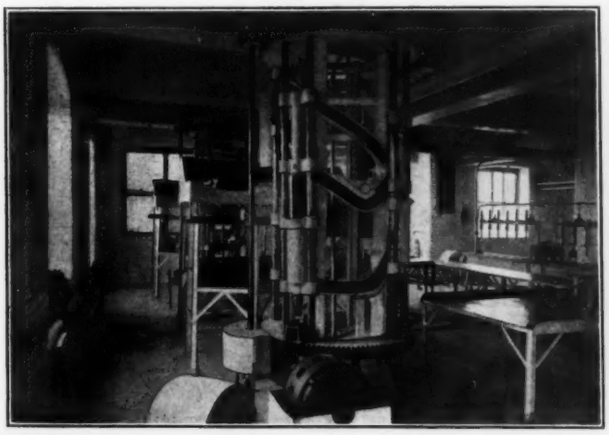


FIG. 1.—MOTOR-DRIVEN STUFFING MACHINE.

hoopers, borers, washers, scourers, etc., in the cooperage plant; paddles, stirrers, etc., in the skin-curing house; cutters, shears, crimpers, etc., in the tin shop; suet-choppers, fat cutters and wringers, stearine presses, lard cylinders, screws, agitators, ice crushers, etc., in the lard and stearine factory; wool-breakers, dryers, dusters, combers, etc., in the wool rooms; pickers, seed-grinders, oil presses, tank agitators, oil pumps, etc., in the cottonseed oil department; and feather fans, hair dryers, etc., in the plants where these products are prepared for market; while hydraulic presses, small pumps of every conceivable description, fans, blowers, elevators, conveyors, separators, hoists and machinery of general utility are electrically operated in all departments and throughout the yards. Then there are the numerous motor-driven tools in the boiler shops, where tanks are made for plants and cars, the woodworking and carpentry shops, machine and general repair shops, and apparatus installed in the coal sheds, power-houses, refrigerating plants, ice houses,

FIG. 2.—MOTOR-DRIVEN MEAT CHOPPER.

ware houses, office buildings, laundries, restaurants and elsewhere—all run by electrical power.

Illustrations of some of this apparatus, showing the induction motors for operating them, may be seen in the accompanying illustrations.

As typical of the best modern practice, both mechanically and from a sanitary standpoint, may be mentioned the nine-story "kitchen" of Libbey, MacNeil & Libbey. Meat from an adjoining slaughter house, after being cut into suitable lengths and thoroughly cleansed, is brought to this building by a motor-driven elevator (or, if corned beef, lifted from the pickle-curing cellar) and transferred in buckets on trolleys

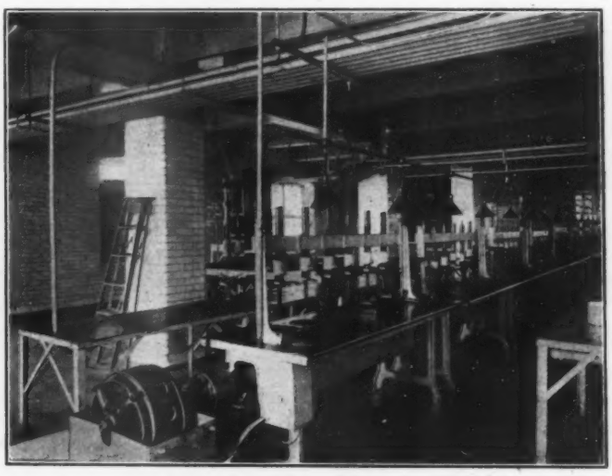


FIG. 3.—MOTOR-DRIVEN CAPPING MACHINE.

to the cooking room which occupies the ninth floor. Here may be seen at a glance the feature which is characteristic of this plant, namely, absolute cleanliness. The walls are faced with pure white enameled brick, the ceilings and floors are of concrete, the window sashes shine with polished metal and there is not a piece of wood either in this or the other rooms to be described.

From the cooking room, meat is sent on enameled motor-driven conveyors to large white tables in the trimming room on the eighth floor, where it is put in shape for the tins.

Flesh representing over 250 cattle can be trimmed here in an hour, with the aid of five meat choppers, each direct-connected to a 2-hp motor (Fig. 2), and three capping benches, each taking its power from a 2-hp motor (Fig. 3), constitute the principal apparatus used. On the sixth floor is the round-canning room, filled with stuffing machines and capping-benches driven in the same manner as those above described. Both floors are equipped with vacuum pans, enabling the cans to be sealed in vacuum. The six American air compressor pumps installed for this service in an adjoining room are driven by belting from one 40-hp motor.

Each of the various conveyors used in these rooms is indirectly driven by a ½-hp motor.

All of the motors use alternating current and are of the so-called "squirrel-cage" induction type built by Allis-Chalmers Company, Milwaukee, Wis. These offer special advantages for the service, being very simple in construction and easy to keep clean. The arrangement of each with respect to the machines is plainly shown by the photographs reproduced in this article.

The fourth and fifth floors are devoted to storage rooms, in which may be found the cans, bottles, jars, glasses, etc., in which the products of the plant are put up.

From the third floor the shipping is done. On the first and second floors are the offices, electric generating plant and refrigerating machines. Here the walls and ceilings are covered with white enamel. With the absence of overhead gear of any kind, good light and ventilation are secured, making the entire plant with apparatus such as that above described, a veritable triumph of sanitation. What part the use of motors plays in this, the reader will readily understand. All tables, trucks, instruments, etc., are in keeping with the rest of the establishment, there being nothing that will absorb moisture, and every fixed piece stands on legs high above the floor, enabling the latter to be thoroughly flushed at the close of each day.

A total reaching many hundreds of millions of dollars is realized each year from the sale of packing-house products, including fresh beef, mutton, pork and veal, corned beef, tongue, ox-tails, hams, bacon, lard, poultry, eggs, butter, butteries, soaps, tallow, glues, oils, bones, fertilizers, pelts, hides, casings, wool, hair, feathers and various other by-products derived from cattle, sheep, hogs and poultry.

The industry is operated on a very narrow margin and, as there are no secret or complicated processes not open to all, packers such as Swift & Company, Armour & Company and Nelson Morris Company must depend for their very existence, as large corporate concerns, upon such advantages as location at the chief live stock centers, manufacturing in large quantities at the minimum of expense, good refrigeration, utilization of all "waste" material, and highly efficient business management, including the use of the very best mechanical methods and appliances. It is here that motor-drive has been taken up with such notable results, particularly in the conversion of "waste" into dollars; for, were it not for the so-called "by-products," there would be, under present conditions of trade, not only scant profit but an actual loss in the handling of meats from live animals.

In each process through which any part of the animal passes, until its last vestige has disappeared in the fertilizer house or glue factory, a great deal of mechanism is used, and most of this is capable of being electrically operated. A mere perusal of the long list of motor-driven machines mentioned in the first part of this article will show even a casual reader what the change from mechanical power transmission to motor-drive means.

So far as economy is concerned, there can be no question but that an enormous saving has been effected; and what is true of one great industry may be applied with equal force to others, similarly situated, which have not yet taken full advantage of their opportunities in this respect.

Electric Furnace for High Temperatures.

The accompanying illustrations show a new electric furnace for the production of carbon-free alloys, the development of a new furnace well suited to this class of work and general high-temperature work, made by the Hoskins Company, of Chicago, Ill.

The new furnace is a modification of the resistance type. A number of carbon or graphite plates are placed face to face along two sides of the furnace between end plates of graphite and with these end plates form the walls of the furnace chamber. Graphite rods contacting with the end plates serve both

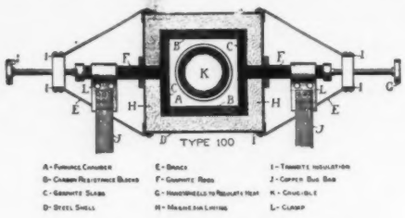


FIG. 1.—DETAILS OF FURNACE.

to connect the resistor into circuit and to communicate pressure to the resistor plates, applied by means of a screw. The resistor and end pieces are surrounded by a refractory material, such as magnesia, and contained in an iron casing. The current is carried to the furnace by heavy copper conductors clamped on the graphite rods.

The furnace operates best at from 10 to 50 volts, depending on the size. Where alternating current is available a special transformer is used to reduce the line voltage to that required by the furnace. An ammeter is connected in the primary circuit as a guide to the control of the furnace. Where alternating current is not available, a rotary converter, a 10-volt plating dynamo or a storage battery may be used.

The furnace is started with little or no pressure on the resistor plates. By increasing the pressure (by simply turning the hand-wheel of one of the screws) the current is brought up to the proper value and is indicated by the ammeter. The heat is developed principally at the points of contact of the

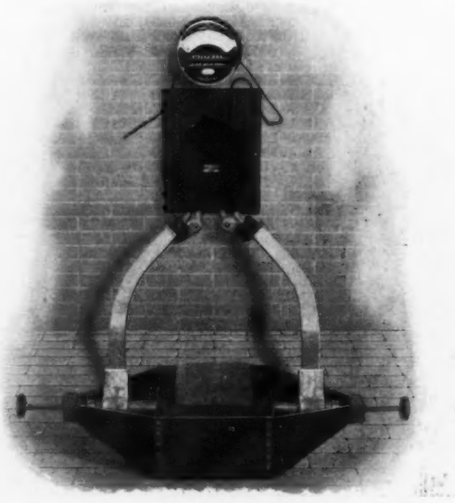


FIG. 2.—FURNACE IN USE.

resistor plates on account of the high resistance at these points.

The resistivity being high compared with that of solid carbon, the cross-section of the resistor can be made large and, therefore, strong and durable. The furnace can be operated efficiently until the resistor is practically all consumed. The renewals are made by inserting the proper num-

ber of plates between the graphite end plates, it being the work of a moment.

The furnace as usually constructed will stand temperatures up to 1800 deg. C., but can be made for a temperature of 2000 deg. C. or above. It is suitable for crucible melting of platinum, gold, silver, nickel, cobalt, copper, iron, chromium, steel, etc.; for heating the barium chloride used in hardening steel; for determining the melting points of fireclay and similar materials, and for general experimental work with refractory materials.

The muffle furnace will not reach the highest temperatures, being limited by the ability of the muffle to stand the heat, but is applicable to the treatment of special steels, for assaying and other work requiring a temperature beyond the safe range of wire-wound furnaces. The tube furnace is applicable to a variety of experimental work requiring a uniform and high temperature under perfect control.

Liquid Starting Rheostat.

The Woolliscroft liquid starting rheostat, made by the Sandycroft Foundry Company, of Chester, England, and shown herewith, differs from other liquid starting rheostats in being totally enclosed, the advantage of which is obvious. It consists essentially of a metal drum, Fig. 1, mounted on two centers about which it can freely revolve. In the lower part of the drum is a solution of caustic soda, which remains stationary; the drum moving about it in the operation of starting and stopping the motor. In the upper portion of the drum and attached to, but insulated from it, are blades which dip into or leave the solution according to the direction in which the drum is being revolved. The blades are short-circuited when they are fully immersed, thus cutting out the resistance. The appliance in various forms is suitable for the operation of either starting and controlling, with or without overload and no voltage releases, reverse controlling for cranes, elevators, hoists, etc., or for automatically starting up machinery that may require working intermittently or on a time limit. In the case of a motor-driven pump, for instance, the starting and stopping are automatically effected at the lowest and highest water levels in a tank or well. The continual presence of an attendant at the pump is, therefore, unnecessary.

Maintaining a constant air pressure in the receiver of an electrically-driven air compressor is by no means as simple as it might on the face of it appear to be. The modification shown in Fig. 2 is designed to do this work automatically, the controller being actuated, within certain predetermined limits, by the air pressure, over which it maintains control. The time taken in cutting out resistance can be varied by means of an oil cataract from two or three seconds to as many minutes. The apparatus is suitable for direct- or alternating-current circuits. The salient features of the controller are: Freedom from sparking; practically no evaporation or creeping of the liquid, and it cannot be burnt out. It can be adapted to any voltage up to 500 by simply altering the density of the solution,

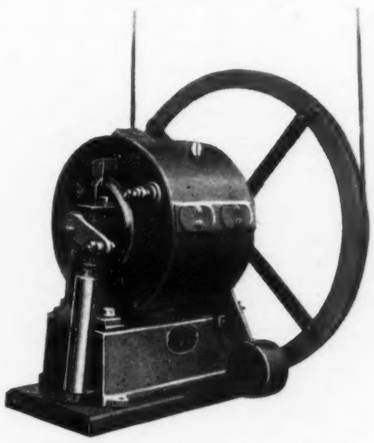


FIG. 1.—AUTOMATIC CONTROLLER SWITCH.

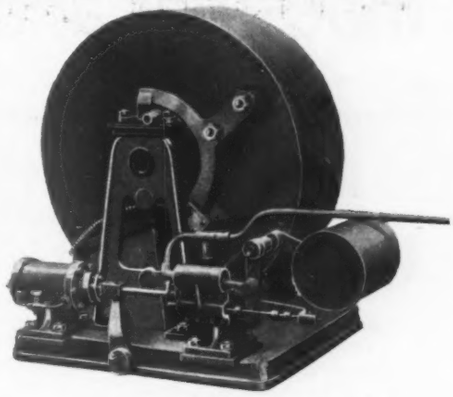


FIG. 2.—LIQUID STARTING RHEOSTAT.

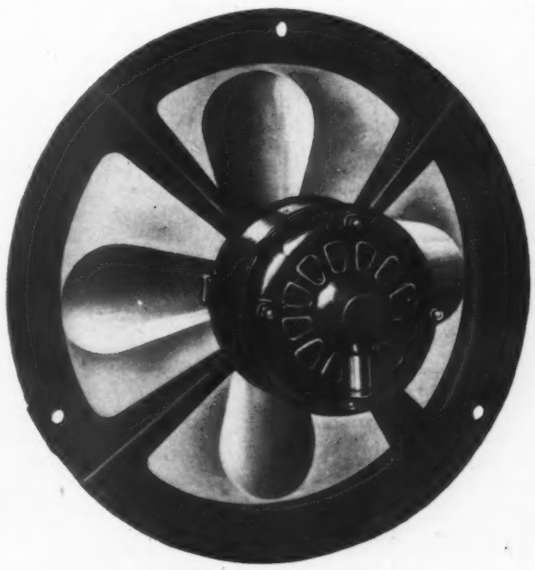
and it has frequently and successfully been substituted for metallic starters which have given trouble.

The Electric Ventilating Fan.

The ventilating fan shown in the accompanying illustration is an addition to the line of Westinghouse fans offered for 1908. As will be seen, it consists of a propeller fan carried on the motor shaft and secured within a circular supporting frame for mounting in any convenient opening. It is designed to act as an exhaust fan for the ventilation of rooms and for drawing off the odors and fumes incident to cooking and similar operations. It exhausts the vitiated air, which is replaced by pure outside air in a natural way without creating any noticeable drafts, and thus affords an effectual and satisfactory method of ventilation.

This fan is made for both alternating and direct-current circuits, and with 12-in. and 16-in. blades. The current consumption is practically the same as that of the Westinghouse desk and bracket fans of the same dimensions.

By exhausting the dead air and drawing in a supply of fresh air to replace it and thus insuring a continuous gentle current, this fan recommends itself as a substitute for the blowing fan wherever the more vigorous action of the latter is undesirable, as, for instance, in the sick chamber and in sleeping apartments, both summer and winter. Wherever another opening is not available, the fan can be readily mounted upon a wooden frame to fit into a corner of the window.



MOTOR-DRIVEN VENTILATING FAN.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Trade reports for the week were, on the whole, rather fair. Easier conditions prevail in the iron and steel markets. Collections remain about the same, money is easier on call and time, and security prices are maintained at the highest level reached on the present spring movement. Railway gross earnings for March show the largest decrease yet reported, and the dulness in building lines affects all lines of materials. Crop reports continue excellent, but with certain sections of the country in need of rain. The combination of circumstances which brought about the immense export movement of last fall and winter seems to have lost its efficacy, and export trade continues to decline. March exports being 15 per cent less than February's exports and 12½ per cent less than those of March a year ago. *Bradstreet's* reports 261 business failures for the week ending April 16, against 258 for the preceding week and 167 for the corresponding week in 1907. Among the large electric companies the export departments continue to show the most activity, but other branches during the last week showed a slight improvement. In New York City and elsewhere last week was "moving week," which for a time always renders affairs more or less chaotic. The improvement during a few weeks in March in the rate at which new business was booked by the General Electric Company, due to three or four large orders, has not been maintained. The General Electric Company, like the Steel Corporation, will, it is stated, make no change of prices in its schedules. Smaller dealers in electrical supplies and contractors report a slight improvement in conditions over the preceding week.

THE COPPER MARKET.—During the week the copper market remained dull but comparatively firm, with prices for electrolytic around 12¾ and 12⅞ cents. The increase in March business proved only temporary, and none of the large electric companies are placing orders of any importance for future delivery. The brass companies, which are doing a good business, are steady buyers, but the speculative element is conspicuous by its absence. Discounting the element of speculation, as matters stand at present there seems to be no reason for a prediction of any considerable change in either direction of the copper market. The shipments of the metal from Atlantic ports since the first of the month aggregate 17,033 tons, and it is interesting to note that, from present indications, by the end of this month the exports will have been about 47,000 tons greater and the imports about 11,000 tons smaller than during the corresponding first four months of last year. The prices for copper at the Metal Exchange on Monday were unchanged and were as follows:

Lake	12¾ @ 12⅞c.
Electrolytic	12⅝ @ 12¾c.
Castings	12⅜ @ 12½c.

The London market was closed on Monday, and Thursday's prices are reprinted, as follows:

	£	s	d	£	s	d
Standard copper, spot	58	12	6	*..	.	.
Standard copper, futures	59	2	6	*..	.	.
Market		Firm.				
Sales of spot				100 tons		
Sales of futures				300 tons		

*Closed until Tuesday.

Extreme fluctuations for the year:

	Highest.			Lowest.		
Electrolytic copper, spot	13¾			12¼		
Lake copper, spot	13⅞			12⅜		
Casting copper, spot	13½			12⅛		
London, spot	£64	5	0	£56	10	0
London, futures	64	10	0	56	17	0
London, best selected	67	10	0	61	0	0

The declaration of the regular quarterly dividend by the Amalgamated Company was expected, but there is some doubt expressed as to the likelihood of the regular dividend being declared at the end of the next quarter. Certainly during the last three months Amalgamated has not been earning 50 cents a share, and unless the copper situation improves considerably the company will either have to reduce the dividend or draw upon the surplus. It is stated on good authority that the Guggenheims are planning to sell their own copper, and that their contract with the United Metals Selling Company, which, it is understood, expires next June, will not be renewed. The Metals Selling Company has never handled the entire output of the American Smelting & Refining Company, but a change in the arrangements between the two interests would involve about 40,000,000 pounds of copper a year. The Arizona Copper Company made a new high production record for March, when the output amounted to 3,096,000 pounds of Bessemer copper. This is at the rate of 37,000,000 pounds a year, as compared with a previous annual production of 28,000,000 pounds.

ELECTRIC COMPANIES MOVING.—The general offices of the Westinghouse Electric & Manufacturing Company at 111 Broadway, the sales offices and export department at 11 Pine Street, and the offices of the Westinghouse Machine Company at 10 Bridge Street, will after April 20, occupy the entire twenty-second floor of the City Investing Building, 165 Broadway. The Westinghouse Air Brake Company will occupy the entire twenty-first floor. Other electric companies moving into the City Investing Building are the American Electrical Works and the Electric Properties Company. On April 23 the General Electric Company occupied its new quarters comprising the entire seventeenth floor of the Cortlandt Building of the Hudson Terminal Buildings at Dey and Fulton Streets, having moved from the Edison Building at 44 Broad Street, where its quarters have been during the last seventeen years. Other companies moving into the Terminal Buildings are the Crocker-Wheeler Company, L. K. Comstock & Co., the American Gas & Electric Company, the National Tube Company, the American Bridge Company, the Electric Controller Supply Company, the Emerson Electric Company, the Electric Service & Supply Company, the Morse Chain Company, the Wagner Electric Manufacturing Company and the Ball & Wood Company.

FOREIGN INDEPENDENTS CUT ALUMINUM PRICES.—Extensive cutting of prices by foreign aluminum producers has resulted in foreign aluminum selling here lower than the home product, although the latter has the advantage of a tariff of 8 cents a pound. The foreign quotations for the white metal delivered here is under 30 cents a pound, while the price of American aluminum is 33 cents a pound. The Aluminum Company of America controls the sole right, under certain patents, to manufacture in this country and Canada, and also has the exclusive right of the International Aluminum Syndicate to sell on this side of the Atlantic for some years to come. The "gentlemen's agreement" in force for the last few years between most of the American and European producers has recently been renewed, but the foreign independents have cut under the market. Last year's production on this side was about 8000 tons of a total world production of 20,000 tons.

IMPROVING MACHINERY BUSINESS.—A canvass of the trade in machine tools, etc., has just been made by *Machinery* that gives plenty of encouragement as to trade conditions. The answers from 723 concerns showed that sales since Jan. 1 had increased with 486, and had not increased with 189, while 48 were indefinite. Collections with the same number had increased in 503 cases and were satisfactory, and were not good in 96 cases, 124 giving no information. The editor, from this and the other data before him, says that the returns show that the corner has been turned. The large makers and dealers are optimistic, while with the smaller makers of light machines and special tools "orders are coming in sufficient volume to show that the manufacturers are making ready for better times."

LARGE LAMP SHIPMENT TO SOUTH AMERICA.—An order for 50,000 incandescent lamps was placed with the Westinghouse Lamp Company by Mr. John B. Orr, an electrical supply importer at Rio de Janeiro, Brazil, last week. This is said to be the largest single lamp contract for South America on record. American goods have an excellent standing in Brazil, Mr. Orr writes, and states that during the last nine months he has sold more than 45,000 lamps in the face of strong German competition.

FOREIGN TELEPHONE OPPORTUNITIES.—An American consular officer writing to the Bureau of Manufactures, states that the time is opportune for the introduction of American telephones in the country which he represents. It is his belief that an American company which means business and will take the proper steps, in all probability may obtain a profitable concession from the government of the country in question. Manufacturers interested should communicate with the consular officer mentioned, who will put them in touch with the proper persons. The consul's address may be obtained from the Bureau of Manufactures.

THE ELECTRICAL TRADES SOCIETY, of New York, is making a vigorous effort to extend its membership. At present the corresponding Chicago society is much in the lead with respect to membership, the claim being made that it exceeds in membership the combined lists of the affiliated societies in Boston, New York, Philadelphia, San Francisco and Montreal. Mr. Franz Neilson, 80 Wall Street, is secretary of the New York Society.

BETHLEHEM STEEL COMPANY ENTERS PRIME MOVER FIELD.—It is announced that the Bethlehem Steel Company will take up the manufacture of gas-engines and steam turbines. For this purpose a power department is being organized, headed by Mr. Arthur West, formerly assistant chief engineer of the Allis-Chalmers Company and chief engineer of the Westinghouse Machine Company.

TELEPHONE SUPPLIES.—An American consular officer of one of the Latin-American countries reports that the owners of the telephone system in the city where he is stationed, are contemplating the purchase of a new switchboard and a change of system. He states that dealers in telephone supplies might do well to communicate with them. Particulars may be obtained by writing to the Bureau of Manufactures.

Financial Intelligence.

THE WEEK IN WALL STREET.—Two holidays immediately before Easter and the tendency of the stock market to mark time rendered last week in the financial district the dullest of the year, the sales for the four days amounting to little more than the business of an ordinary active day. The feature of the week was the activity in the traction shares. The Interborough-Metropolitan 4½ per cent bonds and the preferred stock and the Third Avenue stock made new high records for the year under heavy and continuous buying. With a tendency to decline somewhat in spots, the market on the whole was firm. Among the stocks which showed gains for the week were Canadian Pacific, Union Pacific, Reading, the Steel shares, American Ice and New York Airbrake. Amalgamated was not active, but held well in the face of the depressed copper situation. Money has accumulated in New York in such quantities that the engagement of $2,000,000 gold for shipment to Paris produced no unfavorable impression, and heavier shipments will be viewed without alarm. The general improvement of electrical business conditions is reflected in the advance in prices of the electric shares. The following table shows the net change in the leading electrical securities since the beginning of this year:

	Low for 1908.	April 16.	Net increase.
Allis-Chalmers	5	7½	2½
Allis-Chalmers, pfd.	14	19	5
Am. Tel. & Tel.	101	115½	14½
Gen Electric	111	132	21
Int.-Met., com	6¾	10⅝	3⅞
Int.-Met., pfd.	17⅛	29⅛	12
Mackay Cos.	52	59⅞	7⅞
Mackay Cos., pfd.	59⅞	64¼	4⅜
Met. St. Railway	15	31	16
W. U. Tel.	41	52	11
Westinghouse, com	38	56¼	18¼

The trading in Monday's market was little different in character from the trading of last week, except that the volume of business transacted was somewhat larger. Interborough-Metropolitan stocks and bonds and Third Avenue fell, along with other pool favorites. Closing prices on Monday were as given on this page.

In Boston the 19th of April, Patriots' Day, was celebrated on Monday, which was therefore a holiday.

WESTINGHOUSE ELECTRIC.—*The Wall Street Journal*, in an editorial on the Westinghouse reorganization plan, pays a high tribute to Mr. Westinghouse. "Equal to the achievement of saving the big banks from panic," it says, "will be the achievement of saving George Westinghouse from insolvency. Mr. Westinghouse is an inventive genius whose contributions to his country entitle him to the regard and support of all. His financial troubles are the result of the very largeness of his plans and not of any defect in the plans themselves. If his business foresight did not equal his scientific insight, so that he was caught in a panic which other men far less gifted than he foresaw and prepared for—well, no man can be all things at all times, in all emergencies."

Referring to the reorganization plan, it says: "If the plan goes through the Westinghouse Company will be amply supplied with working capital and for the first time in several years will be given an opportunity to demonstrate what it is capable of doing from the standpoint of earnings when free and unincumbered by debt. The receivership of the Westinghouse Company was due more to an overabundance of prosperity than anything else. In order to keep pace with the growth of the country and the extraordinary demand for its products, it was forced to burden itself with debts running into the millions. Comparing the financial statements of the Westinghouse Company over the last several years it will be found that earnings were increasing and that operating costs were being gradually reduced. The financial panic came at a time when the Westinghouse Company was at the height of its prosperity. The banks and other creditors demanded a settlement which the Westinghouse Company could not meet and a receivership could not be avoided. From present indications the plan of reorganization will be a success. The larger creditors have given it their approval, and it has also received the endorsement of the prominent stockholders. Creditors and stockholders are working in harmony with Mr. Westinghouse in an effort to free the company from receivership and thereby place it on its feet once more. The receivership of the Westinghouse Company does not mean that the corporation is not making a good showing in the matter of earnings. Its earnings for years past have been in excess of dividend requirements. While the company is suffering as a result of the current depression the prospects are that with ample working capital it will be able to make some new high records from the standpoint of income when business conditions become normal, and that stockholders will not have to wait a great while for a restoration of dividends. The successful conclusion of the present reorganization plan will unquestionably result in a material enchancement in the value of the company's securities."

In conclusion the *Journal* says: "Few companies have contributed more toward the development of the country than the Westinghouse Electric & Manufacturing Company and it is because of this that business men hold that a continual receivership and the sale of the property at a sacrifice could be regarded in the light of a national, perhaps international, business calamity."

THE CONSUMERS ELECTRIC COMPANY OF NEW ORLEANS, LA., has been placed in the hands of Samuel Insull, president of the Commonwealth Edison Company, of Chicago, as receiver, following proceedings brought by the National Conduit & Cable Company,.of New York, a holder of mortgage bonds. The company was organized three years ago, with Jules Dreyfus as president.

NEW YORK.

	Apr. 13.	Apr. 20.	Shares Sold.		Apr. 13.	Apr. 20.	Shares Sold.
All-Ch.	7⅜	7¼*	500	Int.-Met., com.	10⅜	10½	40,210
All-Ch. pfd.	20¼	19*	200	Int.-Met., pfd.	28⅜	27¾	51,100
Amal. Cop.	57¼	57	79,830	Mackay Cos.	59⅞	59¾	425
Am. D. T.	39*	39*	——	Mackay Cos., pfd.	65*	64½	300
Am. Loc.	44¼	44¼	2,450	Met. St. Ry.	33	29	700
Am. Loc. Pfd.	91⅜	93½	500	N.Y. & N.J. Tel.	100*	100*	——
Am. Tel & C'bl.	50*	50*	——	Steel, com.	33⅝	37⅞	108,410
Am. T. & T.	113	116½	1,500	Steel, pfd.	91¼	98¼	10,226
B. R. T.	46⅞	46½	37,035	W. U. T.	51	50	1,645
Gen. Elec.	131	132½	600	West'h com.	54¼	55	7,000
Hud. R. Tel.	—	—	——	West'h, pfd.	60*	60*	——

PHILADELPHIA.

	Apr. 13.	Apr. 20.	Shares Sold.		Apr. 13.	Apr. 20.	Shares Sold.
Am. Rys.	42½	42½	——	Phila. Elec.	8	7⅞	——
Elec. Co. of Am.	9 1/16	9½	——	Phila. R. T.	17⅝	17½	——
Elec. Stor. B'ty	28	28	——	Phila. Traction.	86½	89	——
E. S. B'ty pfd.	—	—	——				

CHICAGO.

	Apr. 13.	Apr. 20.	Shares Sold.		Apr. 13.	Apr. 20.	Shares Sold.
Chicago City Ry.	155	155	——	Met. Elec. Com.	16	15	——
Com. Edison.	91¾	—	——	Met. Elec. pfd.	47	47½	——
Chicago Subw'y.	18	—	——	National Carbon.	58	56	——
Chicago Tel. Co.	119	118	——	Nat. Carbon pfd.	109	108	——

*Last price quoted.
Shares sold are for week April 12-16.

NORTH AMERICAN COMPANY DENIES REPORTED LAWSUIT.—Officers and counsel for the North American Company say that there is no truth in the recent report from St. Louis to the effect that Assistant Attorney General Kennish will institute proceedings within the next month, to determine whether or not the North American Company, which controls the Laclede Gas Light Campany and the Union Electric Light & Power Company, is a combination in restraint of trade. "We have received no notice of any such proceedings," said Secretary Burt, of the North American Company, "and I am certain that there is nothing in the report. As a matter of fact, there is a certain newspaper in St. Louis which has made a point of attacking our company by publishing just such rumors, at every opportunity, with no reason that I can discover, except, perhaps, to gain publicity. There is nothing to prevent any one from entering upon just such a suit, but we do not bother ourselves about the outcome in such cases. We do regret such litigation, however, because we are compelled to make answer and that entails considerable expense, and because such litigation might injure our credit with persons who do not fully understand the situation." Mr. A. Jaretzki, of the firm of Sullivan & Cromwell, counsel for the North American Company, was even more certain that no action against the company was contemplated by the Attorney General. He said: "I think I can say positively that the Attorney General will take no steps in that direction. A year ago the District Attorney began some such action against the Union Company, but it never went beyond the mere service of papers. In the first place, the North American Company is a New Jersey corporation and is not amenable to the laws of Missouri. The North American Company owns most of the stock of the Laclede Company and minority holdings in the Union Company, but that in no way constitutes a combination in restraint of trade. We have always been in favor of Public Service Commissions and rate regulations. Our efforts have been to raise our companies to the highest degree of efficiency and economy. If such litigation is contemplated, which I do not believe, it comes rather late, as there is nothing doing in the anti-corporation line in St. Louis at present. Last fall the spasm of so-called reform was at its height and then would have been the psychological moment. Those waves against corporations come along just so often and must be weathered and counted along with other business drawbacks."

MEETINGS AND DIVIDENDS.—The directors of the American District Telegraph Company of New Jersey have declared the regular quarterly dividend of 1 per cent, payable April 22. The annual meeting of the New England Telephone Company will be held May 14, at 11 a. m., at 15 Dey Street. A special meeting of stockholders will be held on the same day, preceding the regular meeting, to vote on certain routine matters. The directors of the Michigan State Telephone Company have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable August 1. Quarterly dividends of 1 per cent, or at the rate of 4 per cent a year, were declared on the common stock, payable June 1. At the annual meeting in Detroit, D. W. Briggs, vice-president of the Bank of Saginaw, Mich., and Russell A. Alger, of Detroit, were elected directors, to succeed Elwood T. Hance, deceased, and W. A. Jackson, who declined re-election. John T. Shaw, president of the First National Bank of Detroit, was elected chairman of the executive committee. The directors of the Electrical Securities Corporation have declared the regular semi-annual dividend of 2½ per cent on the preferred stock, payable May 1. The directors of the Amherst Gas Company have declared a semi-annual dividend of 3 per cent. The East St. Louis & Suburban Company has declared a quarterly dividend of 1¾ per cent on the preferred stock. The Lowell Electric Light Corporation has declared a quarterly dividend of $2 a share on the capital stock. The Houston Co. Electric Light Company has declared a semi-annual dividend of 75 cents per share on the preferred stock and 62½ cents a share on the common stock. The directors of the Montreal Light, Heat & Power Company have declared the regular quarterly dividend of 1½ per cent, payable May 15.

WESTINGHOUSE MERCHANDISE CREDITORS' PLAN.—Judging by the number of responses which have already been received from stockholders in answer to the letter sent out last Thursday by the Stockholders' Committee of the Westinghouse Electric & Manufacturing Company, the result so far has been very gratifying. Not only do the shares already taken up mount into the thousands, but in many cases the stockholders are subscribing for more than their pro rata share of one-fourth. Said one of the members of the committee, while speaking of the progress made so far: "The committee is well pleased with the manner in which the Merchandise Creditors' plan is being received by the stockholders. It shows that they have come to a thorough realization of their position in recognizing that, unless they come forward and do their share toward making this plan a success, they will be the losers. While it is true that for many stockholders it will be hard at this time to find money for the purchase of stock, it must be remembered that in this case they are doing so to preserve the holdings which they already own, and in addition they are giving material aid toward the rehabilitation of a company which has unsurpassed prospects for reimbursing the stockholders for any sacrifice they may be making at the present time. But, as I told you the other day, this plan of the Merchandise Creditors' Committee, while is it a very good one, one thing must not be forgotten, and that is that all the stockholders will have to co-operate and subscribe for their pro rata amount of stock. If they do not, the amount of $10,000,000 which the committee asks for will not be realized, the plan will have to be abandoned, and the future of one of the greatest industrial enterprises in this country, the Westinghouse Electric & Manufacturing Company, will be a very grave one."

INTERBOROUGH NOTES SOLD.—One of the reasons advanced to account for the recent activity in traction shares is the report that J. P. Morgan & Company have taken $25,000,000 of the three-year notes of the Interborough-Metropolitan Rapid Transit Company. A syndicate will be formed by the Morgan interests, it is said, to underwrite the notes, and the issue will be secured by the deposit of the bonds recently authorized by the Public Service Commission. Proceeds from the sale of the notes will be used to take up the $15,000,000 in notes due May 1, and also for other floating debts. It was rumored in Wall Street last week that some of the State Senators who voted against the race-track bills were favored with advance information regarding the success of the Interborough financing. According to the stories circulated, many political obligations have been discharged in the past by market "tips" on traction stocks.

WESTERN UNION DIVIDEND.—Stockholders of the Western Union Telegraph Company will receive as a quarterly dividend of 1¼ per cent, the $1,230,000 capital stock which the governing committee of the Stock Exchange admitted to the list last week. The authorized capital stock of the company is now $125,000,000, of which $10,000,000 is reserved to take care of the $10,000,000 convertible 4 per cent bonds and $15,000,000 will be reserved to take care of $15,000,000 of the same bond issue not yet put forth. There is now outstanding $99,817,000 stock and there remains but $183,000 free stock, allowing for the $25,000,000 to care for the bond issue. The payment of the last stock dividend weakened the market position of the Western Union by bringing into the market a floating supply of stock which had been closely held.

BROOKLYN RAPID TRANSIT.—For the six months ending Dec. 31, 1907, the Brooklyn Rapid Transit Company reports passenger earnings of $9,919,366; freight, mail and express, $191,251; advertising, $77,553; American Railway Traffic Company, $211,401, giving a total earnings from operation of $10,399,571. The total operating expenses were $5,940,726, and the total income $4,817,409. Deducting $3,253,499 for taxes, interest and rentals, leaves a net income of $1,563,910, and deducting special appropriations of $211,705 leaves a surplus of $1,352,205, equal to 3 per cent on the $45,000,000 capital stock.

CHICAGO RAILWAYS.—The Chicago City Railway has been ordered by the Board of Supervising Engineers to spend $2,112,000 on 43¼ miles of track this year and $316,000 on conduit work. Its cars must be taken off Michigan Avenue. No order for new equipment was issued. The Chicago Railways Company was ordered some time ago to spend about $2,000,000 this year, largely for new equipment, and another order will be issued covering track construction work.

WHITNEY COMPANY ATTACHMENT VACATED.—The attachment on the property of the contracting firm of E. A. Gillespie Company, at Whitney, N. C., which was obtained by the receiver of the Whitney Company, was vacated last week by Judge Boyd, at Greensboro, N. C., the receiver having failed to furnish the bond as required by the court.

GENERAL NEWS

Late items are printed unclassified at end of department

Construction News.

BAY MINETTE, ALA.—The City Ice & Light Company contemplates establishing a lighting plant to furnish light for the streets and residences of the town. E. G. Nelson is president of the company.

BIRMINGHAM, ALA.—The City Council of West End has granted the Peoples Home Telephone Company a franchise to install and operate a telephone system in that city.

HARTSELLE, ALA.—The city of Hartselle has purchased the equipment of the old municipal electric light plant at Athens. The machinery will be shipped at once from Athens to Hartselle where it will be installed.

SELMA, ALA.—A company is being organized in this city to furnish electricity for lighting the city. E. C. Melvin, V. B. Atkins, Isaac Schwarz and W. C. Agee are interested in the project.

BISBEE, ARIZ.—The Bisbee Improvement Company has completed the rebuilding of its plant and has installed additional equipment as follows: One Allis-Chalmers, 500-kw, two-phase, 2300-volt, 60-cycle steam turbo-generator set; one 400-hp Stirling water tube boiler; two Alberger condensers, and a nine-panel General Electric alternating-current switchboard. The company will, in the near future, rebuild its transmission lines. C. S. Thompson is manager and I. A. Rosok is electrical engineer.

LITTLE ROCK, ARK.—Plans are being made by the Little Rock & Hot Springs Electric Company to commence work on the construction of its road within 90 days. The company expects to erect its own power station. As yet no contracts have been awarded for material or equipment. The company is capitalized at $2,000,000 and the officers are: C. J. Kramer, president; L. Garrett, vice-president and general manager; J. C. Marshall, secretary; George W. Rogers, treasurer; J. F. Russ, superintendent, and P. M. Pierce, electrical engineer.

FOLSOM, CAL.—The State Board of Prison Directors has decided to issue $6,000 in bonds to install an entirely new electric light plant for the penitentiary at Folsom.

SAN DIEGO, CAL.—The City Council has passed an ordinance for erecting and maintenance of ornamental iron posts carrying clusters of incandescent electric lamps on Sixth Street, between C and F Streets.

SAN FRANCISCO, CAL.—The estimate of expenses for the next fiscal year prepared by the Department of Electricity for the Board of Supervisors is $275,450, of which $70,588 will be required for restoration of police-signal system, $19,867; restoration of the overhead fire- and police-alarm systems, $9,844; underground, $93,700.

SAN ANSELMO, CAL.—The third-rail electric system of the Northwestern Pacific Company's North Shore system has been extended from San Anselmo to Fairfax. Steam cars will be operated in addition to the electric service until the large power house in San Anselmo is completed, as the present power plant of the company is unable to furnish energy to transport the increasing traffic from Fairfax to this place.

SANTA CRUZ, CAL.—The Coast Counties Power Company is planning to install another unit of 750 kilowatts in the power plant at the Beach. The company expects to have its Soquel extension completed to the city limits by next fall. F. E. Fitzpatrick is general manager.

SONORA, CAL.—The Stanislaus Electric Power Company has filed a notice of appropriation of 8,000 in. of water in the Stanislaus River, two miles below Baker's Crossing, to be used to generate electricity and for mining, irrigation and domestic purposes.

WHITTIER, CAL.—Plans are being considered by the city for the construction of a municipal electric light plant. A committee, consisting of N. T. Edwards, C. F. Klingberg and H. E. Humphrey, has been appointed by the Board of Trade to investigate the matter. It is estimated that a plant can be installed in connection with the present municipal pumping plant for about $75,000.

COLORADO SPRINGS, COL.—A company has been formed by J. A. Hayes, president of the First National Bank of Colorado Springs, for the purpose of utilizing the water power of the Grand River to generate electricity to pump water for irrigating a large tract of land east of Grand Junction.

DENVER, COLO.—Plans are being considered for equipping the Denver, Northwestern & Pacific Railroad to be operated by electricity over the Continental Divide, and if plans are consummated the six-mile tunnel now projected will be abandoned. Estimates of the cost are now being prepared by the Central Colorado Power Company. D. H. Moffatt is president of the electric company.

DANIELSON, CONN.—The Wauregan Company is making arrangements to light its entire plant with electricty, and has placed an order for a generator with sufficient output to operate 1500 lamps. The mill will be rewired, and the gas lighting system will be discarded.

MIDDLETOWN, CONN.—The Middletown Electric Light Company is considering the construction of an entirely new plant. The company contemplates installing steam turbines.

WASHINGTON, D. C.—We are informed that the Washington Railway & Electric Company contemplates increasing the output of its power station and will install one 900-kw turbine; one 1000-kw frequency set and a 1000-kw railway rotary converter. The company also expects to award a contract for the construction of a car barn; about 3100 ft. of new track and the purchase of a new suburban car. H. W. Fuller is general manager.

ATLANTA, GA.—The Atlanta & Carolina Railway Company has been authorized by the State Railroad Commission to issue $6,000,000 in bonds. The proposed railway will be 200 miles long and will connect Atlanta and Augusta. James W. English, of Atlanta, is president of the company.

BLUE RIDGE, GA.—The city is making arrangements to commence work on the construction of an electric light plant, water works system and other improvements. W. C. Boling is Mayor.

CEDARTOWN, GA.—The citizens will vote on the proposition to issue $30,000 in bonds for extensions to the light, water and sewer systems and street improvements. R. O. Pitts is Mayor.

MILLEDGEVILLE, GA.—The capital stock of the Oconee River Mills has been increased to $250,000. The company is planning the construction of a hydro-electric plant from 500 to 1000 horse-power. F. D. Milstead, of Atlanta, is preparing estimates of the work.

REYNOLDS, GA.—Plans are being considered by D. S. Sanders for the installation of an electric light plant, for which the following equipment will be required: A dynamo, a 10-hp gasoline engine, switchboard, 4000 ft. No. 8 insulated wire, lamps and accessories.

SPARKS, GA.—Contracts for the construction of an electric light plant and water works system have been placed by the City Council with J. B. McCrary & Company, of Atlanta, work on which will commence at once.

CALDWELL, IDAHO.—Plans are being made by the Long Distance Independent Telephone Company to make extensive improvements to its system throughout Ada and Canyon Counties.

WEISER, IDAHO.—The City Council is considering the proposition sumbitted by O. G. F. Markus, general manager of the Oxbow Power & Light Company. The company proposes to erect a substation near the municipal electric plant to furnish electricity to operate the pumping plant.

BARTONVILLE, ILL.—The Interstate Telephone Company has applied to the City Council for a franchise to operate a telephone system in this city.

CHICAGO, ILL.—We are informed that the Woodstock & Sycamore Electric Railway Company is planning to commence construction of its railway in June. The road will be 25 miles in length and will connect Woodstock, Franklinville, Marengo, Geneva, Sycamore and De Kalb. The power station will be located at Marengo. Charles A. Spenny, Tacoma Building, Chicago, is secretary and treasurer.

CHICAGO, ILL.—Plans are being considered by the Chicago & Oak Park Elevated Railroad Company for the construction of an extension to Elmhurst, a distance of five miles. It is said that the extension is to be built by a new company, controlled by the same interests.

EAST ST. LOUIS, ILL.—We are informed that practically all the right of way and franchises have been secured for the proposed electric railway, which the Woodriver, East Alton & Bunker Hill Traction Company proposes to construct between Woodriver and Litchfield and intervening towns. The road will be 60 miles in length. The power station and repair shops will be located at Bethalto. The company also proposes to furnish electricity for lamps and other purposes to the towns along the route. The company is capitalized at $250,000, and the officers are J. T. W. Rudisell, president; R. A. Mavey, vice-president; S. B. Kueffer, secretary, and R. M. Smith, treasurer, all of East St. Louis.

SHAWNEETOWN, ILL.—The Independent Telephone Company contemplates installing a new telephone system in this city.

FORT WAYNE, IND.—The Fort Wayne & Wabash Valley Traction Company is making plans for the construction of a concrete dam on the St. Joseph River at Robison Park.

LIBERTY, IND.—G. E. Stevenson, chairman of the light committee of the Town Council, writes that the town does not intend to install a municipal plant, but invites the establishment of a central station by private capital.

SPENCER, IND.—The Reliance Engineering Company, of Columbus, Ohio, will have charge of the construction of electric light plant and water works system for Spencer. The cost of the plants is estimated at $35,000. The lighting plant will have an output of 200 kilowatts.

KIOWA, KAN.—Plans have been prepared by Burns & McDonnell, Kansas City, Mo., for a water works system, to cost $40,000, and an electric light plant to cost $12,000. An election will be held on April 30 to vote on the proposition to issue bonds for construction of these plants.

LEAVENWORTH, KAN.—The People's Home Telephone Company is contemplating the installation of a telephone system at Fort Leaven-

worth, which will involve an expenditure of about $30,000. The company is also erecting lines to Kickapoo and other points.

McPHERSON, KAN.—An appraisal of the water works system and electric light plant is being made by Burns & McDonnell, of Kansas City, Mo., with a view of their being purchased by the city. Estimates and plans for improvements to the water and lighting systems are also being made.

SALINA, KAN.—Contracts have been placed by the Salina Street & Interurban Company for equipping the local street car system to be operated by electricity. The present system is operated by gasoline motors.

ELKTON, KY.—The switchboard of the Home Telephone Company in this city was recently destroyed by fire.

FRANKFORT, KY.—The Capitol Commissioners will consider plans for construction of a power house and equipping a plant to furnish electricity for lamps, etc., and for heating the building. Governor Augustus Wilson recently approved a bill appropriating $460,000 for completing and furnishing the new capitol.

EUNICE, LA.—The Council is considering the question of establishing a municipal electric light plant.

NEW ORLEANS, LA.—The Consumers' Electric Company, of which Samuel Insull, of Chicago, Ill., was recently appointed receiver, is planning large extensions to its business. It is proposed to extend its service to the residence section of the city. Its territory is now limited to the commercial district.

NEW ORLEANS, LA.—Bids will be received until May 20 by the vice-president of the Board Solvent for the construction and equipment of a steam power house, boiler plant, etc., for the Charity Hospital, in accordance with plans and specifications on file with John Ponder, chief engineer of the hospital. The plans call for a 600-hp plant, the cost of which is estimated at $52,000. Edwin Marks is secretary and treasurer.

NEW ORLEANS, LA.—Bids will be received at the office of the Sewerage and Water Board until June 30 for furnishing and installing the following machinery: Two 100-kw, 250-volt, direct-current generators; two 75-hp, 250-volt motors; one 2,500,000-gal. turbine pump, to work against a 125-ft. head, direct connected to an electric motor; one 1,000,000-gal. triplex pump, to work against a 125-ft. head, geared to an electric motor; one 2,000,000-gal. centrifugal pump unit, to work against a 20-ft. head; two 4,000,000-gal. centrifugal pump units, to work against a 20-ft. head; two 5-hp, 250-volt motors; one surface condenser, capable of condensing 6500 lb. of steam per hour, together with air pump. Also all exhaust and water piping, valves, wiring, switchboard, lamps and other appurtenances, completely installed. Specifications with blank form of proposals may be obtained at the office of the board, 602 Carondelet Street. Plans will be furnished only upon personal application. F. S. Shields is secretary of the board.

PEMBROKE, MAINE.—The plant of the Pembroke Light & Power Company was destroyed by fire on April 11, causing a loss of about $10,000.

RICHMOND, MAINE.—The citizens have voted to authorize the Selectmen to make a contract for lighting the streets of the village with electricity for a term of five years.

AMHERST, MASS.—The directors of the Amherst Gas Company have decided to install two new boilers in its electric power plant and to make additions to the switchboards.

MARBLEHEAD, MASS.—The Electric Light Commissioners have placed a contract for the new boiler for the electric light plant.

SOMERVILLE, MASS.—The Edison Electric Illuminating Company has petitioned the Board of Aldermen for permission to locate and maintain conduits for its wires in Willow Avenue, Highland Avenue, Davis Square and Holland Street, for the purpose of carrying its high-tension wires from the electric light station on Willow Avenue on to Arlington, where a substation is to be established. The company has notified the Council that this work will be done, in addition to the $20,000 which the company is required by law to spend on underground work each year.

CLOQUET, MICH.—The Great Northern Power Company, of Duluth, is making surveys in the vicinity of Cloquet Dam on the Cloquet River, in Section 15, 52-54. It is stated that the company contemplates the construction of a concrete dam 45 ft. high to replace the present 15-ft. dam. E. P. Coleman, of Duluth, is manager and chief engineer.

DETROIT, MICH.—At the annual meeting of the Michigan State Telephone Company, held recently, D. W. Briggs, of Saginaw, and Russell Alger, of Detroit, were elected directors to succeed Elwood T. Hance, deceased, and W. A. Jackson, who declined re-election. The other directors were re-elected. John T. Shaw, of Detroit, was elected chairman of the executive committee.

GRAND RAPIDS, MICH.—The East Side Power Company is contemplating changing its power plant from water to electrical power, the energy to be generated from the present water-power rights of the company. The company is considering the question of applying to the Council for permission to erect transmission lines to distribute electricity throughout the city. R. W. Irwin is president of the company.

IRON RIVER, MICH.—Plans are being prepared by Edward P. Burch, consulting engineer, Minneapolis, Minn., for a 400-hp water power development for the Menomonee Range Power & Development Company.

COLERAINE, MINN.—A telephone company has been organized in this city to install an Independent telephone system, work on which will begin at once. The company is capitalized at $10,000.

CROOKSTON, MINN.—Plans have been prepared by the Ambursen Hydraulic Construction Company for the construction of the proposed dam across the Red River, near Climax, the cost of which is estimated at $250,000. Elias Steenerson, of Crookston, is interested in the project.

LITTLE FALLS, MINN.—A rural telephone company is being formed in this place to construct a rural line to connect with the exchange at Little Falls. Barney Burton is interested in the project.

ST. PETER, MINN.—Plans are being considered by the City Council for making improvements and increasing the output of the municipal electric light plant, which include the installation of a new generator and engine. F. H. Silverton is superintendent.

SAUK RAPIDS, MINN.—The Village Council has placed contracts with the General Electric Company, of Schenectady, N. Y., for two generators for the municipal electric light plant.

BILOXI, MISS.—The City Council has entered into an agreement with the Gulfport & Mississippi Coast Traction Company for lighting the streets of the city. By terms of the agreement the company is to furnish 12 arc lamps at $8 each per month, 100-cp tungsten lamps at $3 each per month, and as many 32-cp incandescent lamps as the city may call for at the rate of $1.87½ each per month.

NATCHEZ, MISS.—Bids will be received at the office of the city clerk until May 6 for lighting the streets of the city for a term of five years, from March 1, 1909. George T. Eisele is city clerk.

WIGGINS, MISS.—The Town Council on April 9 revoked the franchise of the Cumberland Telephone & Telegraph Company and granted a franchise to Mr. Fougolson and others to erect a telephone system in the town.

ALVA, MO.—The Alva Electric Railway is making arrangements to construct a power house, the equipment of which will include a 300-kw, three-phase, 60-cycle, 6600-volt alternator, direct connected to water turbine and two motor generator sets. Contracts for rails, ties, water power plant, auxiliary steam plant with an output of 200 kilowatts, will be awarded within 30 days. J. B. Quigley is chief engineer.

DORA, MO.—The Martin Power Company contemplates the construction of a dam and power plant on the Big North Fork River near Dora, and erecting transmission lines to West Plains, a distance of 200 miles, to furnish electricity for lamps and motors. Charles K. Martin will have charge of the work.

ST. LOUIS, MO.—The King Electric Light Company and the Suburban Electric & Power Company have both filed petitions in the St. Louis County Court recently asking that their franchises be extended. The former company asks that it be allowed to furnish service in all of the county north of the Clayton, the Conway and the Wild Horse Creek roads, while the latter company wants to furnish electricity in the rest of the county.

GLENDIVE, MONT.—The Hughes Electric Telephone Company contemplates the construction of a telephone line to Miles City.

HELENA, MONT.—The Hauser Lake Dam across the Missouri River, owned by the Helena Power Transmission Company, was partially washed away on April 15 by the flood. The dam was completed last year and furnishes electrical energy for smelters and manufacturing plants in Helena, Butte and Anaconda. It is estimated that the dam can be rebuilt for $250,000. The company now supplies electricity from the Canyon Ferry Dam and its steam station in Butte. M. H. Gerry, Jr., is manager.

CONCORD, N. H.—G. W. Lincoln, of Hillsboro, has acquired the telephone lines of the New England Telephone & Telegraph Company between this city and Peterboro, which will be known as the Contoocook Valley line. Mr. Lincoln contemplates the purchase of several other lines.

LEBANON, N. H.—Plans are being made by H. W. Carter & Sons to equip their factory to be operated by electricity. Energy for operating the plant will be furnished by the local electric company.

WOLFBORO, N. H.—The village fire precinct has voted to contract with S. W. & J. L. Clow to furnish power for the municipal electric light plant at the rate of $2,750 per year for five years, or for any portion of said term, pro rata, if the precinct shall see fit to install a plant of its own. It was also voted to purchase the old shoe factory property at a cost not to exceed $4,000. A committee was appointed, consisting of Henry B. Furber, George W. Berry, Fred Mayhew, Harry L. Miles and Chester Hawkins to take charge of the shoe factory property and investigate all matters pertaining to the new plant and the removal of the present plant to the new location.

FRANKLIN, N. C.—A proposition for installing an electric light plant has been submitted to the town authorities by J. F. Palmer.

FULLERTON, N. C.—A contract has been awarded by the Gulf Lumber Company to the General Electric Company, of Schenectady, N. Y., for three 500-kw generators and other equipment necessary for an electric power plant to furnish electricity for lamps and motors in the town.

GOLDSBORO, N. C.—A franchise has been awarded to E. T. Oliver, of Raleigh, to construct and operate a street railway in this city.

HICKORY, N. C.—It is reported that the Water Power Electric Company will soon commence work on the construction of its proposed hydro-electric plant on the Catawba River, three miles from Hickory. The work includes the construction of a concrete dam 18 ft. high and 400 ft. long, with penstocks and power house, etc. About 3000 horse-power will

be developed at first, which will be transmitted to Hickory and surrounding country. M. E. Thornton, of Hickory, is president of the company.

NEWARK, N. J.—A committee has been appointed by the Freeholders of Essex County to investigate the question of installing an electric light plant in the court house. The present contract with the Public Service Corporation, under which it costs the county from $900 to $1,200 per year to light the building, will expire in September.

TRENTON, N. J.—The House of Representatives passed the bill allowing the Atlantic County Traction Company to extend its railway through the camp grounds at Sea Girt, with the permission of the Governor and quartermaster-general.

TRENTON, N. J.—The Trenton Iron Company, during the past year, has increased the equipment of its power station by the installation of an Allis-Chalmers 24 in. x 32 in. double-acting tandem gas engine, direct connected to a 350-kw, 550-volt, direct-current generator; also a gas producing plant, including a coal handling device, furnished by R. D. Wood & Company, of Philadelphia, Pa.

WOODBURY, N. J.—The Pitman Electric Light Company has petitioned the town officials for a franchise to establish an electric light plant. The Public Service Corporation is now furnishing electricity for lighting the town.

TUCUMCARI, N. M.—The Tucumcari Telephone Company contemplates the installation of a new telephone system in this city, the cost of which is estimated at $20,000. H. Gerhardt is interested in the company.

BROOKLYN, N. Y.—In the naval appropriation bill passed by Congress extensive improvements are planned for the Brooklyn Navy Yard, among which are included $40,000 for extension to electric light plant, $25,000 for extension to underground conduits, $115,000 for completing heating plant and $12,000 for telephone system.

GENEVA, N. Y.—The Economic Power & Construction Company has been granted permission to enter the extension of the conduit system, which is to be built through Franklin Street to connect with the city's system on Seneca and Exchange Streets, at the rate of five cents per duct foot.

GOSHEN, N. Y.—The Goshen Light & Power Company contemplates making application to the Public Service Commission, Second District, for permission to issue $15,000 in bonds, of which the proceeds of $6,000 will be used to take up an issue of bonds falling due in June, and the balance to be used for the construction of a transmission line to Monroe, and to change the present generating plant at Goshen to a transformer station. The company proposes to obtain electrical energy for operating its system from the Orange & Rockland Electric Company at Monroe.

INTERLAKEN, N. Y.—Plans are being considered for the merger of the Trumansburg Home Telephone Company's system and the plant of the Bell Telephone Company, which will be operated from one exchange.

LOCKPORT, N. Y.—The International Power & Transmission Company, a subsidiary of the Niagara, Lockport & Ontario Power Company, which recently applied to the City Council for a franchise to furnish electricity for light, heat and power, has withdrawn its application. It is stated that the Public Service Commission has granted the Lockport Light, Heat & Power Company a non-competitive field in this city as long as it did not raise its present rates.

MT. SINAI, N. Y.—The citizens of this place and Millers Falls and vicinity are contemplating having an electric system installed in the different villages.

NEW YORK, N. Y.—Bids will be received until April 27 by C. B. J. Snyder, superintendent school buildings, for installing electrical equipment in Public School No. 155, and in new Public School No. 117, corner of Herkimer Street and Eastern Parkway, Borough of Brooklyn.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has made application to the Public Service Commission, Second District, for permission to issue $1,474,000 in bonds, for the purpose of refunding obligations of the company.

WEST POINT, N. Y.—Bids will be received until May 11 for furnishing and installing electric and combination gas and electric light fixtures for officers' quarters, as per plans and specifications in this office. Forms of proposals furnished on application. For further information address the quartermaster, West Point.

LIDGERWOOD, N. D.—The Lidgerwood Rural Telephone Company is making arrangements to erect a number of rural telephone lines in the near future.

ANNA, OHIO.—The Village Council is advertising for bids for the construction of a municipal electric light plant. H. G. Hagelberger is clerk.

CINCINNATI, OHIO.—Plans are being considered for the construction of a new boiler and power house for the Bethesda Hospital, to cost about $35,000.

CLEVELAND, OHIO.—The Board of Public Service has approved the franchises for the Cuyahoga Lighting Company and the Cleveland Electric Illuminating Company. The downtown streets only were covered by the approved franchises, as the conduits had been laid in that section of the city under permits granted by the board.

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WATERTOWN, S. D.—The installation of a new exchange in this city is under consideration by the Dakota Central Telephone Company.

worth, which will involve an expenditure of about $30,000. The company is also erecting lines to Kickapoo and other points.

McPHERSON, KAN.—An appraisal of the water works system and electric light plant is being made by Burns & McDonnell, of Kansas City, Mo., with a view of their being purchased by the city. Estimates and plans for improvements to the water and lighting systems are also being made.

SALINA, KAN.—Contracts have been placed by the Salina Street & Interurban Company for equipping the local street car system to be operated by electricity. The present system is operated by gasoline motors.

ELKTON, KY.—The switchboard of the Home Telephone Company in this city was recently destroyed by fire.

FRANKFORT, KY.—The Capitol Commissioners will consider plans for construction of a power house and equipping a plant to furnish electricity for lamps, etc., and for heating the building. Governor Augustus Wilson recently approved a bill appropriating $460,000 for completing and furnishing the new capitol.

EUNICE, LA.—The Council is considering the question of establishing a municipal electric light plant.

NEW ORLEANS, LA.—The Consumers' Electric Company, of which Samuel Insull, of Chicago, Ill., was recently appointed receiver, is planning large extensions to its business. It is proposed to extend its service to the residence section of the city. Its territory is now limited to the commercial district.

NEW ORLEANS, LA.—Bids will be received until May 20 by the vice-president of the Board Solvent for the construction and equipment of a steam power house, boiler plant, etc., for the Charity Hospital, in accordance with plans and specifications on file with John Ponder, chief engineer of the hospital. The plans call for a 600-hp plant, the cost of which is estimated at $52,000. Edwin Marks is secretary and treasurer.

NEW ORLEANS, LA.—Bids will be received at the office of the Sewerage and Water Board until June 30 for furnishing and installing the following machinery: Two 100-kw, 250-volt, direct-current generators; two 75-hp, 250-volt motors; one 2,500,000-gal. turbine pump, to work against a 125-ft. head, direct connected to an electric motor; one 1,000,000-gal. triplex pump, to work against a 125-ft. head, geared to an electric motor; one 2,000,000-gal. centrifugal pump unit, to work against a 20-ft. head; two 4,000,000-gal. centrifugal pump units, to work against a 20-ft. head; two 5-hp, 250-volt motors; one surface condenser, capable of condensing 6500 lb. of steam per hour, together with air pump. Also all exhaust and water piping, valves, wiring, switchboard, lamps and other appurtenances, completely installed. Specifications with blank form of proposals may be obtained at the office of the board, 602 Carondelet Street. Plans will be furnished only upon personal application. F. S. Shields is secretary of the board.

PEMBROKE, MAINE.—The plant of the Pembroke Light & Power Company was destroyed by fire on April 11, causing a loss of about $10,000.

RICHMOND, MAINE.—The citizens have voted to authorize the Selectmen to make a contract for lighting the streets of the village with electricity for a term of five years.

AMHERST, MASS.—The directors of the Amherst Gas Company have decided to install two new boilers in its electric power plant and to make additions to the switchboards.

MARBLEHEAD, MASS.—The Electric Light Commissioners have placed a contract for the new boiler for the electric light plant.

SOMERVILLE, MASS.—The Edison Electric Illuminating Company has petitioned the Board of Aldermen for permission to locate and maintain conduits for its wires in Willow Avenue, Highland Avenue, Davis Square and Holland Street, for the purpose of carrying its high-tension wires from the electric light station on Willow Avenue on to Arlington, where a substation is to be established. The company has notified the Council that this work will be done, in addition to the $20,000 which the company is required by law to spend on underground work each year.

CLOQUET, MICH.—The Great Northern Power Company, of Duluth, is making surveys in the vicinity of Cloquet Dam on the Cloquet River, in Section 15, 52-54. It is stated that the company contemplates the construction of a concrete dam 45 ft. high to replace the present 15-ft. dam. E. P. Coleman, of Duluth, is manager and chief engineer.

DETROIT, MICH.—At the annual meeting of the Michigan State Telephone Company, held recently, D. W. Briggs, of Saginaw, and Russell Alger, of Detroit, were elected directors to succeed Elwood T. Hance, deceased, and W. A. Jackson, who declined re-election. The other directors were re-elected. John T. Shaw, of Detroit, was elected chairman of the executive committee.

GRAND RAPIDS, MICH.—The East Side Power Company is contemplating changing its power plant from water to electrical power, the energy to be generated from the present water-power rights of the company. The company is considering the question of applying to the Council for permission to erect transmission lines to distribute electricity throughout the city. R. W. Irwin is president of the company.

IRON RIVER, MICH.—Plans are being prepared by Edward P. Burch, consulting engineer, Minneapolis, Minn., for a 400-hp water power development for the Menomonee Range Power & Development Company.

COLERAINE, MINN.—A telephone company has been organized in this city to install an Independent telephone system, work on which will begin at once. The company is capitalized at $10,000.

CROOKSTON, MINN.—Plans have been prepared by the Ambursen Hydraulic Construction Company for the construction of the proposed dam across the Red River, near Climax, the cost of which is estimated at $250,000. Elias Steenerson, of Crookston, is interested in the project.

LITTLE FALLS, MINN.—A rural telephone company is being formed in this place to construct a rural line to connect with the exchange at Little Falls. Barney Burton is interested in the project.

ST. PETER, MINN.—Plans are being considered by the City Council for making improvements and increasing the output of the municipal electric light plant, which include the installation of a new generator and engine. F. H. Silverton is superintendent.

SAUK RAPIDS, MINN.—The Village Council has placed contracts with the General Electric Company, of Schenectady, N. Y., for two generators for the municipal electric light plant.

BILOXI, MISS.—The City Council has entered into an agreement with the Gulfport & Mississippi Coast Traction Company for lighting the streets of the city. By terms of the agreement the company is to furnish 12 arc lamps at $8 each per month, 100-cp tungsten lamps at $3 each per month, and as many 32-cp incandescent lamps as the city may call for at the rate of $1.87½ each per month.

NATCHEZ, MISS.—Bids will be received at the office of the city clerk until May 6 for lighting the streets of the city for a term of five years, from March 1, 1909. George T. Eisele is city clerk.

WIGGINS, MISS.—The Town Council on April 9 revoked the franchise of the Cumberland Telephone & Telegraph Company and granted a franchise to Mr. Fougolson and others to erect a telephone system in the town.

ALVA, MO.—The Alva Electric Railway is making arrangements to construct a power house, the equipment of which will include a 300-kw, three-phase, 60-cycle, 6600-volt alternator, direct connected to water turbine and two motor generator sets. Contracts for rails, ties, water power plant, auxiliary steam plant with an output of 200 kilowatts, will be awarded within 30 days. J. B. Quigley is chief engineer.

DORA, MO.—The Martin Power Company contemplates the construction of a dam and power plant on the Big North Fork River near Dora, and erecting transmission lines to West Plains, a distance of 200 miles, to furnish electricity for lamps and motors. Charles K. Martin will have charge of the work.

ST. LOUIS, MO.—The King Electric Light Company and the Suburban Electric & Power Company have both filed petitions in the St. Louis County Court recently asking that their franchises be extended. The former company asks that it be allowed to furnish service in all of the county north of the Clayton, the Conway and the Wild Horse Creek roads, while the latter company wants to furnish electricity in the rest of the county.

GLENDIVE, MONT.—The Hughes Electric Telephone Company contemplates the construction of a telephone line to Miles City.

HELENA, MONT.—The Hauser Lake Dam across the Missouri River, owned by the Helena Power Transmission Company, was partially washed away on April 15 by the flood. The dam was completed last year and furnishes electrical energy for smelters and manufacturing plants in Helena, Butte and Anaconda. It is estimated that the dam can be rebuilt for $250,000. The company now supplies electricity from the Canyon Ferry Dam and its steam station in Butte. M. H. Gerry, Jr., is manager.

CONCORD, N. H.—G. W. Lincoln, of Hillsboro, has acquired the telephone lines of the New England Telephone & Telegraph Company between this city and Peterboro, which will be known as the Contoocook Valley line. Mr. Lincoln contemplates the purchase of several other lines.

LEBANON, N. H.—Plans are being made by H. W. Carter & Sons to equip their factory to be operated by electricity. Energy for operating the plant will be furnished by the local electric company.

WOLFBORO, N. H.—The village fire precinct has voted to contract with S. W. & J. L. Clow to furnish power for the municipal electric light plant at the rate of $2,750 per year for five years, or for any portion of said term, pro rata, if the precinct shall see fit to install a plant of its own. It was also voted to purchase the old shoe factory property at a cost not to exceed $4,000. A committee was appointed, consisting of Henry B. Furber, George W. Berry, Fred Mayhew, Harry L. Miles and Chester Hawkins to take charge of the shoe factory property and investigate all matters pertaining to the new plant and the removal of the present plant to the new location.

FRANKLIN, N. C.—A proposition for installing an electric light plant has been submitted to the town authorities by J. F. Palmer.

FULLERTON, N. C.—A contract has been awarded by the Gulf Lumber Company to the General Electric Company, of Schenectady, N. Y., for three 500-kw generators and other equipment necessary for an electric power plant to furnish electricity for lamps and motors in the town.

GOLDSBORO, N. C.—A franchise has been awarded to E. T. Oliver, of Raleigh, to construct and operate a street railway in this city.

HICKORY, N. C.—It is reported that the Water Power Electric Company will soon commence work on the construction of its proposed hydroelectric plant on the Catawba River, three miles from Hickory. The work includes the construction of a concrete dam 18 ft. high and 400 ft. long, with penstocks and power house, etc. About 3000 horse-power will

be developed at first, which will be transmitted to Hickory and surrounding country. M. E. Thornton, of Hickory, is president of the company.

NEWARK, N. J.—A committee has been appointed by the Freeholders of Essex County to investigate the question of installing an electric light plant in the court house. The present contract with the Public Service Corporation, under which it costs the county from $900 to $1,200 per year to light the building, will expire in September.

TRENTON, N. J.—The House of Representatives passed the bill allowing the Atlantic County Traction Company to extend its railway through the camp grounds at Sea Girt, with the permission of the Governor and quartermaster-general.

TRENTON, N. J.—The Trenton Iron Company, during the past year, has increased the equipment of its power station by the installation of an Allis-Chalmers 24 in. x 32 in. double-acting tandem gas engine, direct connected to a 350-kw, 550-volt, direct-current generator; also a gas producing plant, including a coal handling device, furnished by R. D. Wood & Company, of Philadelphia, Pa.

WOODBURY, N. J.—The Pitman Electric Light Company has petitioned the town officials for a franchise to establish an electric light plant. The Public Service Corporation is now furnishing electricity for lighting the town.

TUCUMCARI, N. M.—The Tucumcari Telephone Company contemplates the installation of a new telephone system in this city, the cost of which is estimated at $20,000. H. Gerhardt is interested in the company.

BROOKLYN, N. Y.—In the naval appropriation bill passed by Congress extensive improvements are planned for the Brooklyn Navy Yard, among which are included $40,000 for extension to electric light plant, $25,000 for extension to underground conduits, $115,000 for completing heating plant and $12,000 for telephone system.

GENEVA, N. Y.—The Economic Power & Construction Company has been granted permission to enter the extension of the conduit system, which is to be built through Franklin Street to connect with the city's system on Seneca and Exchange Streets, at the rate of five cents per duct foot.

GOSHEN, N. Y.—The Goshen Light & Power Company contemplates making application to the Public Service Commission, Second District, for permission to issue $15,000 in bonds, of which the proceeds of $6,000 will be used to take up an issue of bonds falling due in June, and the balance to be used for the construction of a transmission line to Monroe, and to change the present generating plant at Goshen to a transformer station. The company proposes to obtain electrical energy for operating its system from the Orange & Rockland Electric Company at Monroe.

INTERLAKEN, N. Y.—Plans are being considered for the merger of the Trumansburg Home Telephone Company's system and the plant of the Bell Telephone Company, which will be operated from one exchange.

LOCKPORT, N. Y.—The International Power & Transmission Company, a subsidiary of the Niagara, Lockport & Ontario Power Company, which recently applied to the City Council for a franchise to furnish electricity for light, heat and power, has withdrawn its application. It is stated that the Public Service Commission has granted the Lockport Light, Heat & Power Company a non-competitive field in this city as long as it did not raise its present rates.

MT. SINAI, N. Y.—The citizens of this place and Millers Falls and vicinity are contemplating having an electric system installed in the different villages.

NEW YORK, N. Y.—Bids will be received until April 27 by C. B. J. Snyder, superintendent school buildings, for installing electrical equipment in Public School No. 155, and in new Public School No. 117, corner of Herkimer Street and Eastern Parkway, Borough of Brooklyn.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has made application to the Public Service Commission, Second District, for permission to issue $1,474,000 in bonds, for the purpose of refunding obligations of the company.

WEST POINT, N. Y.—Bids will be received until May 11 for furnishing and installing electric and combination gas and electric light fixtures for officers' quarters, as per plans and specifications in this office. Forms of proposals furnished on application. For further information address the quartermaster, West Point.

LIDGERWOOD, N. D.—The Lidgerwood Rural Telephone Company is making arrangements to erect a number of rural telephone lines in the near future.

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WOLSEY, S. D.—The citizens are considering the question of establishing a municipal electric light plant.

MEMPHIS, TENN.—We are informed that the Lake View Traction Company expects to begin the construction of its road this coming summer. The proposed electric railway will be 150 miles in length and will connect Memphis, Covington, Collierville and Clarksdale and intermediate towns. The company plans to erect its power house and repair shop at Lake View and also to operate an amusement park at that place. The capital stock of the company is placed at $2,500,000. H. E. Craft is vice-president.

CLEBURNE, TEX.—Receiver William Battle, of the Cleburne Water, Ice & Lighting Company, has been granted permission by the court to issue $35,000 in certificates for improvements to the plant.

CORPUS CHRISTI, TEX.—The City Council has granted a franchise to Clark Pease and associates to construct and operate an electric light plant in this city.

TYLER, TEX.—Bids will be received until May 20 at the office of the supervising architect, Treasury Department, Washington, D. C., for the installation of a conduit and electric wiring system for the United States post office and court house building and extension at Tyler, in accordance with drawing and specifications, copies of which may be had at the above office, or at the office of the superintendent of construction, Tyler, Tex. James Knox Taylor is supervising architect.

SALT LAKE CITY, UTAH.—The Board of County Commissioners has granted franchises to the Utah Light & Railway Company to lay double tracks on several streets. The company is planning to make extensive improvements to its system outside of the city.

LEXINGTON, VA.—The heating and power plant of the Washington and Lee University was damaged by fire on April 11, causing a loss of about $5,000.

PULASKI, VA.—Plans are being considered by the City Council for improving the municipal electric light plant.

RICHMOND, VA.—The City Council is considering the matter of submitting to the voters at the June election the question of a bond issue for a municipal electric lighting plant. The Council has already appropriated the sum of $6,000 to determine the cost of the plant, plans for which are now being prepared by E. W. Trafford.

RICHMOND, VA.—During the past year the Virginia Passenger & Power Company has installed a 3250-kw, Allis-Chalmers turbine and a 750-kw Allis-Chalmers alternator, driven by Leffel water wheels in the Twelfth Street power house, and a 900-kw General Electric alternator driven by Holyoke Machine Company water wheels, in the Locks power house, near Petersburg. The company has also installed 250 magnetite lamps in Petersburg, operated by rectifiers. The receivers of the company have received permission from the United States courts to place its wires in underground conduits in certain portions of the city. Plans have also been prepared by the receivers for the construction of a substation on Church Street, which is to be a duplicate of the one recently completed on West Broad Street, the cost of which is estimated at $70,000. George H. Whitfield is general superintendent of light and power.

SPANISH OAKS, VA.—The Appomattox Telephone Company contemplates extending its lines from Appomattox to Spout Spring, thence to Oakville, Spanish Oaks and Karl, and also to extend a line from Spout Spring to Concord Depot.

BLAINE, WASH.—It is reported that the British Columbia Electric Company has leased or purchased the Great Northern Railway Company's track from Cloverdale to Blaine, a distance of six miles, and when the Great Northern abandons the line for its water front road the electric company will equip the road to be operated by electricity.

CHEHALIS, WASH.—The Washington Home Telephone Company contemplates installing a local telephone system in this city.

ENTAIT, WASH.—Bids are being received by Gray & Barash, People's Bank Building, Seattle, Wash., for the construction of the power house and also for cedar poles for transmission line for the Entait Power Company.

GRANGER, WASH.—It is reported that an electric light plant will be installed here in the near future.

LOOMIS, WASH.—The Nighthawk Mining Company has nearly completed the reconstruction of the electric lighting and power plant, stamp mill and tramway on its property at the base of Mountain Ellemehan, near Loomis.

OROVILLE, WASH.—The Dividend Mine, located on the Okanogan River, about four miles north of Oroville, is reported to have been purchased by a New York syndicate. It is understood that the mine will soon be in operation and that the new company will secure electrical service from the Similkameen Power Company for lighting and operating its plant.

SEATTLE, WASH.—Plans for the new power plant for the State University have been approved by the Board of Regents. The cost of the plant is estimated from $75,000 to $100,000.

WALLA WALLA, WASH.—The County Commissioners have granted a franchise to the Oregon Traction Company for an electric railway along the east side of the city to the Washington Cemetery.

MARTIN, W. VA.—Plans are being considered by the Mutual Telephone Company for the construction of a telephone system in this city, work on which will commence soon.

BUFFALO (COCHRANE, P. O.), WIS.—The capital stock of the Diamond Telephone company has been increased from $500 to $1,500. Walter Reid is secretary.

THERMOPOLIS, WYO.—H. J. Thompson, of Billings, has taken an option on the plant and holdings of the Hot Springs Electric Light & Power Company. It is understood that the price to be paid for the plant is $30,000. If taken over, it is said that extensive improvements will be made to the system.

EDMONTON, ALB., CAN.—Sealed tenders will be received by John Stocks, deputy minister of the Department of Works, until April 30 for the necessary equipment for the installation of 700 miles of rural telephone line to be built by the government.

EDMONTON, ALB., CAN.—Bids will be received until May 1, by R. R. Keely, city engineer, for the construction of a power house for the municipal electric light plant, to be operated by producer-gas engines, the cost of which is estimated at $20,000. The plant will have an output of 700 kilowatts.

PINCHER CREEK, ALB., CAN.—The citizens are considering the installation of an electric lighting plant here. Mayor Scott is making investigations to determine the equipment for the plant.

CRANBROOK, B. C., CAN.—The Bull River Power Company is now constructing a plant on the Bull River near here. George Henderson, manager, states the ultimate output of the plant will be about 9000 horse-power.

KILLARNEY, MAN., CAN.—Messrs. Skinner & Colison, of Estevan, Sask., are considering the advisability of installing an electric lighting plant here.

WINNIPEG, MAN., CAN.—The Civic Board of Control has decided to notify all companies having wires on the streets of Winnipeg that they must be placed underground within a year from date. Only a certain area in the center of the city is affected.

WINNIPEG, MAN., CAN.—The Manitoba Iron Works Company has completed the installation of electric motors throughout its works, which were formerly operated by steam. The company will require about 250 horse-power of electrical energy to operate its plant, which will be supplied by the Winnipeg Electric Company.

New Industrial Companies.

THE DURBAN ELECTRICAL SUPPLY COMPANY, of Oklahoma City, Okla., has been incorporated with a capital stock of $10,000. The incorporators are G. B. Stone, T. E. Durban and S. L. Lawless.

THE JUST-TUNGSTEN ILLUMINATING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $250,000, by Michael Moran, of Brooklyn, and Pasquale Mastrorelli, of New York, N. Y.

THE X-RAY ELECTRIC LAMP COMPANY, of Augusta, Me., has been incorporated, with a capital stock of $500,000, for the purpose of manufacturing electrical appliances. J. Berry, of Augusta, is president and treasurer.

THE ELECTRIC WELDING COMPANY, of Brooklyn, N. Y., has filed articles of incorporation. The company is capitalized at $24,000, and the directors are Ove Lange, Christian Nielsen and Herman O. Mundsen, all of Brooklyn.

THE MARSHAL ELECTRIC COMPANY, of Kittery, Maine, has been incorporated with a capital stock of $50,200, for the purpose of manufacturing electrical appliances. H. Mitchell, of Kittery, is president and clerk, and S. J. Morrison, of Portsmouth, N. H., treasurer.

THE NEW BRIDGE INCANDESCENT LIGHT COMPANY, of New York, N. Y., has filed articles of incorporation with the Secretary of State. The company is capitalized at $20,000, and the incorporators are: Bernard Rudolph, Abraham Rudolf and Louis Rudorfer, all of New York, N. Y.

THE GAS PRESSURE REGULATING & EQUIPMENT COMPANY, of Jersey City, N. J., has been incorporated, with a capital stock of $100,000, by Louis W. Jacobs, Albert H. Gindele and Peter H. James, of Jersey City, N. J. The company proposes to manufacture gas and other lamps; gas and electrical works, etc.

THE STANDARD INSTRUMENT COMPANY, of Newark, N. J., has filed articles of incorporation, with a capital stock of $100,000. The incorporators are: Irving K. Loveless, of Orange; Charles O. Nillson, of Brooklyn, N. Y., and George L. Taylor, of Belleville, N. Y. The company proposes to do a general electrical and mechanical engineering business.

THE TERRY TENCH & PROCTOR TUNNELING MACHINE COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $1,500,000, for the purpose of manufacturing tunneling machinery, engines, motors, etc., and also to construct tunnels. The incorporators are: J. J. Banks, of Denver, Col.; A. S. Luria and E. E. Morris, of New York, N. Y.

THE ATLANTA ILLUMINATING & ELECTRICAL ENGINEERING COMPANY has recently been organized, with offices at 218 Peters Building, Atlanta, Ga. The company proposes to make a specialty of electrical and illuminating engineering, and would like to receive publications, descriptive matter and catalogues pertaining to electrical and illuminating subjects. Lewis L. Barnes is interested in the company.

THE RIDGWAY COMPANY, of Columbus, Ohio, will be incorporated soon, with a capital stock of $25,000, for the purpose of handling mechanical and electrical machinery and apparatus. This is an outgrowth of Ridgway & Company, a firm which has been doing business in the Columbus Savings & Trust Building for some time. The new location will be at 422 North High Street, where quarters are being fitted up. Harry G. Ridgway, who was with the Westinghouse Company for 22 years, will be the head of the new corporation. Among the different concerns which the company will represent are the following: Platt Iron Works, Buffalo Forge Company, Ohio Injector Company, Western Electrical Company, Dunlap Manufacturing Company, Valley Iron Works, Jacobson Gas Engine Works, Ohio Blower Company, Pulsometer Steam Pump Company, Ames Iron Works, Edge-Moor Boiler Company and the Link Chain Belt Company. A telephone department will be a feature of the company. A full line of motors, generators, arc lamps, engines and compressors will be handled.

Company Elections.

DENVER, COL.—At the annual meeting of the Northern Colorado Power Company the following-named officers were elected: W. J. Barker, president; George C. Smith, vice-president; George Best, secretary, and Thomas Keeley, treasurer.

SPRINGFIELD, OHIO.—At the annual meeting of the stockholders of the People's Light, Heat & Power Company the old board of directors was re-elected and was organized by choosing the same officers who served last year.

PHILADELPHIA, PA.—At the annual meeting of the Philadelphia Electric Company the retiring board of directors was re-elected.

LIVINGSTON, MONT.—At the annual election of the New World Reduction & Power Company the following officers were elected: J. R. Brown, of Spokane, Wash., president; Sir Walter Gillis, of Hexham, Eng., vice-president, and H. H. Farber, of Seattle, Wash., secretary. The company has under construction at Cook City a 200-ton smelter with a 6000-hp electric power plant.

New Incorporations.

BAKERSFIELD, CAL.—The Kern County Mutual Telephone Company has been incorporated. The officers of the company are F. G. Munzer, president; T. Spellacy, vice-president; H. W. Thomas, secretary, and James T. Maguire, treasurer.

LOS ANGELES, CAL.—The Glendora Light & Power Company has been incorporated, with a capital stock of $20,000.

SALINAS, CAL.—The Pacific Grove Heat, Light & Power Company, with a capital stock of $25,000, has been incorporated by H. E. Hales, S. J. Evans and W. Smith, all of Los Angeles.

SAN JOSE, CAL.—The Alviso Electric Light & Power Company, with a capital stock of $100,000, has been incorporated by G. L. Donovan, J. N. Thane, J. A. Belloli, Jr., Theodore Belloli and L. E. Munier.

WASHINGTON, D. C.—A bill has been introduced into the State Legislature of Maryland to incorporate the Washington, Patuxet & Drum Point Railroad to build a railroad to be operated by either steam or electricity from a point on the Chesapeake Beach Railway to Soloman's Island, passing through Calvert, Prince George, and Arundel Counties. The capital stock of the company is placed at $250,000, and the incoropators are: Ira J. Baker, Charles C. Mayer, of Washington, D. C.; C. A. M. Wells, Joseph R. Owens, Rexford M. Smith, Wallace A. Barlett and Charles A. Wells.

Legal.

NEGLIGENT MAINTENANCE OF GUY WIRE.—It is negligent to maintain a guy wire from a telephone post to the ground some 25 feet therefrom, and within the line of travel between a street and railroad station grounds, without anything to attract attention of one approaching the station in the dark. This, in brief, is a recent holding of the Court of Appeals of California. The gist of the liability consists in the fact that the person injured did not act merely for his own convenience and pleasure, but from motives to which no act or sign of the owner or occupant contributed, and that he entered the premises because he was led to believe that they were intended to be used by visitors. The case would be no different in principle if defendant had stretched a barbed wire or dug a ditch across a part of the traveled way, although the danger of accident might have been somewhat increased. Grant v. Sunset Telephone & Telegraph Co., 94 Pac. 368.

MUNICIPAL LIGHTING IN BAY CITY RESTRAINED.—By a decision handed down by Judge Wisner in the Genesee County Court, the city of Bay City, Mich., is restrained from building and equipping a new electric lighting plant for the purpose of engaging in commercial lighting. Judge Wisner made permanent the temporary injunction issued several weeks ago by the Circuit Court Commissioner, D. H. Thompson, in the case of the Bay City Traction Company vs. Bay City, seeking to restrain the city from building its proposed municipal lighting plant. At the conclusion of the argument the judge held that the proceedings of the Common Council in the matter were irregular, in that a resolution declaring the new plant a necessity was not adopted; that the Board of Estimates had not provided for the necessary expenditures and that if the city went on with the work, it would find itself behind financially at the close of the year.

TROLLEY POLES HELD NOT TO BE NUISANCES.—The poles belonging to an electric street railway, located along a street, are not in themselves nuisances; but permission to place its poles along a public street does not authorize the company to locate its poles so as unduly and unnecessarily to interfere with the public streets. Thus the New York Court of Appeals holds that a street railway company is legally responsible for the injuries of a fireman, injured by collision with one of its poles, while responding to a fire. The pole was located at the edge of the paved way near the fire house, and the injured fireman was standing on the side step of the patrol wagon, waiting for one who was ahead of him to get inside so that he could follow, when the accident occurred. The trial court held as matter of law that the defendant was not guilty of any negligence in locating the pole as it did, and that the plaintiff was guilty of contributory negligence in endeavoring to get into the wagon as he did. The Appellate Division, on the contrary, held that both of these questions were for the jury, and this holding was affirmed by the Court of Appeals, the Court taking occasion to say: "A piece of fire apparatus going to a fire is not only permitted, but expected, to go rapidly, and especially as the horses first came out of the barn it should be anticipated that they would not be under perfect control or in a regular gait, or that in making a right-angle turn from the driveway into the street towards the pole, as was being done on this occasion, mathematical accuracy could be observed in keeping the apparatus in the centre of the driveway." Lambert v. Westchester Electric Ry. Co., 83 N. E. Rep. 977.

TELEPHONE COMPANY ENTITLED TO INJUNCTION PROTECTING ITS LINES.—A Michigan telephone company instituted a bill for an injunction to prevent the cutting of its wires by a person engaged in the business of moving buildings. It was shown that the defendant contemplated moving a large barn along one of the streets of the village of Paw Paw, and that, to this end, it would be necessary to remove 28 of the company's wires which were so located as to interfere with the progress of the barn. The company proposed to the defendant that the work of cutting the wires be done by its linemen and that the defendant secure the company in some way against the actual expense which would have amounted to about $15. This the defendant refused to do and shortly thereafter he notified the telephone company that he was about to move the structure and that he would tear down as many of the company's wires as would be found necessary to provide a free passage for the building along the highway. A statute of the state of Michigan provides that every telephone company organized thereunder shall have the power to construct and maintain lines for the transmission of telephone messages through public streets and highways, with all necessary erections and fixtures therefor, provided that the same shall not injuriously interfere with "other public uses" of such places. The defense was that the telephone company, by the maintenance of its wires, was interfering with "other public uses" of the highway, one of which was the defendant's right to use the highway for purposes of house moving. It was held that the use to which the defendant wished to put the highway an extraordinary one and a "public use" within the meaning of the statute. The telephone company, having organized under an act of legislature and erected its lines pursuant to the direction of the authorities of the village in such a manner as not to interfere with all ordinary uses of the streets, gained vested rights therein paramount to the defendant's right to convey buildings through those streets. And the cutting of its wires by the defendant, if allowed, would have amounted to an appropriation of the company's property without due process of law. On these grounds the injunction was granted. Kibbie Telephone Co. v. Sandphere, Supreme Court of Michigan, 115 N. W. Rep. 244.

Obituary.

MR. CHARLES A. MURPHY, of Brooklyn, N. Y., one of the promoters of the Key West Electric & Railway Company, of Key West, Fla., and a former president of the Brooklyn Heights Improvement Company died recently.

MR. CHARLES WILLIAMS, a prominent manufacturer of electrical goods, died April 14, in Somerville, Mass., of bronchial pneumonia. With Professor Bell he erected the first telephone line used in Boston. He was an original stockholder of the Bell Telephone Company.

MR. SAMUEL B. RAWSON, president of the Dean Electric Company, of Elyria, Ohio, died April 10, from heart disease. He was 59 years old, and was president of the Dean Electric Company and head of the so-called Rawson syndicate of independent telephone men, which has financed telephone companies in many American cities. He is survived by a widow and one daughter.

MR. JAMES HISLOP, president of the New London Gas & Electric Light Company, New London, Conn., died in that city March 30. He was born in Peebles, Scotland, Feb. 9, 1847, and came to America in 1807, and settled in New London in 1878, to engage in the dry goods business as Hislop, Porteons & Mitchell, which subsequently became the firm of James Hislop & Company. He was a prominent citizen of New London, and was noted for his charities, which were mostly devoted to bettering the condition of the poor. He is survived by his wife, daughter and two sons.

MR. HOSMER BUCKINGHAM PARSONS, president of the Wells-Fargo Bank and director of the Knickerbocker Trust Company and other

financial institutions, died April 16 at his home, 168 Lincoln Place, Brooklyn, N. Y., of pneumonia. He was born in Houvelton, N. Y., Jan. 6, 1846. Mr. Parsons was director of the Augusta-Aiken Electric Railway Company, the Knickerbocker Express Company, the North Augusta Electric & Improvement Company, and other companies. He was trustee of the Brooklyn Institute of Arts and Sciences, and a member of the Lawyers Club, the Society of Colonial Wars and the New York Chamber of Commerce.

Personal.

MR. GEORGE B. SPRING has been appointed superintendent of the Ayer Electric Light & Power Company, Ayer, Mass., succeeding Mr. A. H. Paine, resigned.

MR. WILLIAM G. CHAMBERLAIN, recently in the mechanical department of the Whitney Electrical Instrument Company, has become connected with the Hoyt Electrical Instrument Works, of Penacook, N. H.

MR. BURTON FRENCH, formerly superintendent of overhead and underground lines for the Commonwealth-Edison Company, of Chicago, Ill., has been appointed superintendent of the Consumers' Electric Company, of New Orleans, La.

MR. OSCAR A. FRICK has severed his connection as electrical engineer with the Westinghouse Electric & Manufacturing Company and has accepted a position as assistant to the general manager of the Presumpscot Electric Company, of Westbrooke, Maine.

MR. GEORGE L. COLGATE, of Batavia, N. Y., instead of Mr. George L. Collins, as reported in the issue of April 18, was appointed general manager of the Ontario Light & Traction Company and the Canandaigua Gas Light Company of Canandaigua, N. Y.

MR. LEWIS R. FOMEROY, who for a number of years has been a special representative of the General Electric Company in the railway field, has joined the Safety Car Heating & Lighting Company as assistant to the president, with offices at 2 Rector St., New York.

MR. B. A. BEHREND, who for eight years past has been chief engineer of the Bullock Electric Manufacturing Company, and for the past four years chief electrical engineer of the Allis-Chalmers Company, has moved to Milwaukee, Wis., where his address will be 2102 Grand Ave.

MR. JAMES WILSON, who has been superintendent of Victoria Park, Canadian side at Niagara, ever since it was instituted, and who has had much to do with the power development plans on that side of the river, has tendered his resignation. Mr. Wilson, more than any other man, made Victoria Park the beauty spot it is.

MR. W. P. WHITTEMORE, manager of the municipal electric light plant and water works system at North Attleboro, Mass., has notified the Water and Electric Light Commissioners that he will not accept a reappointment. His term expires this month. Mr. Whittemore has been in the service of the town for the past 23 years.

MR. FRED. T. DODGE has resigned from the electrical department of the Whitney Electrical Instrument Company to accept a position with the Hoyt Electrical Instrument Company, of Penacook, N. H. Mr. Dodge had been with the Whitney Company since 1892, with the exception of a short period on the staff of the General Electric Company.

MR. NORMAN G. MEADE, the electrical engineer, who was formerly associated with the Westinghouse interests, is to be the editor of the new series of the New York Edison Company's *Bulletin*, and in charge of the department of publicity. A book on practical motor work by Mr. Meade is soon to be issued by the McGraw Publishing Company.

MR. CHARLES HENRY DAVIS is the subject of a biographical sketch printed in a supplement to the April 10 issue of *The Harlan Enterprise*, of Harlan, Kentucky. The supplement is probably the most sumptuous publication of the kind ever published by an American journal. It is from the press of the John A. Lowell Bank Note Co., of Boston, and consists of a cover and 42 pages, 15 x 21 in., of engravers plate paper containing more than two hundred excellent half-tone engravings. The greater portion of the text and illustrations relate to the Kentenia Corporation, of which Mr. Davis is president and principal owner. The corporation has a capital of $10,000,000 and owns 75,000 acres of land.

Unclassified Items.

CLEVELAND, OHIO.—The North Electric Company has increased its capital stock from $1,750,000 to $2,250,000.

RED KEY, IND.—An election will be held to vote on the proposition to issue $12,000 electric light bonds.

CLEVELAND, OHIO.—The capital stock of the Forest City Railway Company has been increased from $2,000,000 to $6,000,000.

WELCH, W. VA.—The Welch Ice & Cold Storage Company has been granted a franchise to furnish the city with electricity for lamps and motors.

EDINBURG, VA.—H. A. Whissen & Brother have been granted a franchise to erect an electric light plant in this city. J. D. Lemmon is mayor.

NEW LONDON, WIS.—A new 100-hp engine and alternator will be added to the equipment of the municipal electric light plant during the coming year.

ORIENT, WASH.—H. D. Merritt, of Spokane, has applied to the Commissioners of Ferry County for permission to install electric lamps and lay water mains in the town of Orient.

LEAKSVILLE, N. C.—The Leaksville Light, Power & Milling Company, recently incorporated, will establish an electric light and power plant, work on which will begin within a few months.

PLACERVILLE, CAL.—The Board of Trustees has engaged J. W. White, engineer, of San Francisco, to prepare plans and estimates of the cost of the proposed municipal electric light and power plant.

WARREN, PA.—At the annual meeting of the Warren Street Railway Company the following named officers were elected: D. H. Siggins, president; J. D. Woodard, secretary, and H. A. Siggins, treasurer.

HELENA, MONT.—The Helena Light & Railway Company is considering an extension of its railway to the State Fair Grounds, an addition to the car barns and the purchase of ten new open cars, which will involve an expenditure of about $70,000.

WARREN, PA.—At the annual meeting of the Warren-Jamestown Railway Company the following named officers were elected: D. H. Siggins, president; Homer M. Preston, vice-president; Samuel Q. Smith, secretary, and John M. Siegfried, treasurer.

BOWLING GREEN, OHIO.—The Lake Erie, Bowling Green & Napoleon Railway Company has been granted a franchise for its proposed railway from this city west to the county line at Grand Rapids. The company proposes to build as far as Tontogany, seven miles distant, this summer.

HONESDALE, PA.—The Honesdale & Hawley Trolley Railroad Company has been reorganized under the name of the Lackawaxon Valley Railway Company and the following named officers elected: E. B. Hardenbergh, president; Henry W. Dunning, of Wilkes-Barre, secretary, and Charles E. Dodge, treasurer.

NEWVILLE, PA.—Arrangements are being made by the Newville Electric Light Company for the Construction of a dam above the former Wade Mill, north of Newville, recently purchased by the company. The mill will be converted into a power plant. A steam engine will be installed to furnish power to the generators until the water power can be utilized.

WAUKESHA, WIS.—The Waukesha Gas & Electric Company has adopted an amendment to its articles of incorporation, providing for the construction and operation of a heating plant. The company will erect a larger plant, with new machinery throughout, with sufficient boiler capacity to furnish heat to the business section of the city.

HARRISBURG, PA.—Application will soon be made to Governor Stuart for a charter for the Schuylkill & Dauphin Traction Company by J. W. Moyer, Edgar D. Rank, Malcolm G. Stewart, Louis H. Schappell and N. D. Yoder. The company proposes to build an electric railway system connecting the more important towns in Lykens Valley and western Schuylkill County.

COLUMBIA, S. C.—The Columbia Electric Street Railway Comapny is making arrangements to install a new 1000-kw generator in its water-power plant and would like to receive bids on the same. The company is also in the market for an exciter set for the above, governors for the water wheels, and a new set of water wheels for the water-power station. William Elliott is general manager.

REDLANDS, CAL.—The Yucaipa & Oakglen Railroad Company has been organized, and will construct at once an electric railway from this city to the Yucaipa, seven miles distant. By fall the road will be completed to Oakglen, 22 miles from Redlands, and will eventually be extended to Beaumont and San Jacinto. The officers of the company are J. F. Neeland, of Los Angeles, president; C. S. Chesnut, of Redlands, vice-president; M. N. Newmark, of Los Angeles, treasurer.

ST. LOUIS, MO.—Bids will be received at the office of the Board of Public Improvements until May 1 for furnishing designs, plans, tools, labor and material, building foundations and erecting in boiler house No. 2, Bissell's Point, four 350-hp boilers, with Roney mechanical stokers, Foster superheaters, setting valves, etc. Plans may be seen and specifications and form of contract may be obtained upon application at the office of the Water Comissioner, room 312, new city hall. Andrew J. O'Reilly is president.

Removals.

THE CHAS. J. BOGUE ELECTRIC CO. will move May 1 to 513 West Twenty-ninth Street, New York.

MR. HENRY FLOY, consulting engineer, has removed his offices from the St. Paul Building, 220 Broadway, to a suite on the 14th floor of the new City Investing Building, 165 Broadway.

NEW WESTINGHOUSE OFFICES.—The executive offices of the Westinghouse Electric & Manufacturing Company, now at 111 Broadway, New York, N. Y., and the New York sales offices and export offices of that company, now at 11 Pine Street, will be removed on Monday, April 20, 1908, to the new City Investing Building, No. 165 Broadway, New York.

THE EXCELLO ARC LAMP COMPANY, of New York, moved this week to 30-32 East Twentieth Street, near Broadway, where it has taken a floor store and basement. The ground floor will be used for exhibit rooms and offices and the basement for storage and workshop.

The move was made necessary by the increasing demand for Excello arc lamps, compelling the company to remove to larger quarters.

BULLOCK ELECTRIC MFG. CO.—On April 23, the sales, patent, engineering, drafting and order departments of the Bullock Electric Manufacturing Company, which for the past nine years have been at the Bullock Company's offices at Norwood, Ohio, were moved to the general offices of the Allis-Chalmers Company at West Allis, Milwaukee, Wis., thus concentrating the different executive departments at Milwaukee. Among the men transferred to Milwaukee are Mr. J. R. Jeffrey, assistant secretary of the Bullock Company and assistant manager of the electrical department, Mr. C. E. Lord, patent counsel, Mr. H. A. Behrend, chief engineer, Mr. D. Hall, assistant chief engineer and the other important members of the electrical departments of the Allis-Chalmers Company. A special Pullman vestibule train conveyed the party of almost 100 persons from Cincinnati to Milwaukee.

Business Notes.

MR. J. M. SCHILLING, formerly traveling in the retail and supply department for Illinois territory of the Westinghouse Electric & Manufacturing Company, at Chicago, has been appointed in charge of lamp sales for the Westinghouse Lamp Company at the Chicago office.

MR. WILLIAM L. CUMMISKEY, formerly with the Ewing-Merkle Electric Co., of St. Louis, as sales manager, has joined the staff of W. N. Matthews & Brother as sales representative in the state of Illinois, where he has entered on an active campaign pushing Stombaugh guy anchors and the well-known Matthews line of cable joints and fittings and arc lamp fittings.

THE JOHN A. STEWART ELECTRIC CO., of Cincinnati, Ohio, has supplied to the Interurban Railway & Terminal Co., Cincinnati & Eastern Division, two 300-kw 25-cycle rotary converters complete with switchboards and oil cooled transformers for installation at the main power house near Coney Island, Ohio.

THE CARLISLE & FINCH COMPANY, Cincinnati, Ohio, has developed a large business in search lights, both in the home and foreign markets, shipments being made to Japan, Australia, South America, Canada and Europe. Its line of search lights is in sizes from 9 in. to 38 in., the former being for yachts and small vessels.

THE NATIONAL CARBON COMPANY, of Cleveland, Ohio, from all reports, is doing a much more satisfactory business than at any time since the financial strigency began. New orders are coming in at a very satisfactory rate and collections have improved wonderfully. These facts indicate that business over the country is showing up in an encouraging manner.

APPLE ELECTRIC COMPANY.—Messrs. H. F. Apple, O. D. Apple and V. G. Apple have withdrawn from the Dayton Electrical Manufacturing Company and have gone in business on their own account as the Apple Electric Company. The new company has already on the market an improved storage battery and will shortly announce a new dynamo-floating storage-battery ignition system, which will contain a number of up-to-date improvements not found in other apparatus now on the market. Mr. V. G. Apple still retains his interest in the Dayton Electrical Manufacturing Company and will continue to serve as its vice-president.

McADAMITE.—Mr. R. L. Johnston, secretary of the United States McAdamite Metal Co., of Brooklyn, N. Y., recently delivered an address before the members of the Aero Club of America, having for his subject the new aluminum alloy, McAdamite, which roughly speaking, is 2 to 4 times stronger and very much lighter than ordinary brasses in general use to-day. During the course of his talk, Mr. Johnston demonstrated the strength of this alloy by screwing into a bar of McAdamite a ½ in. steel bolt, under the head of which were placed enough washers to allow the bolt to enter the bar of metal only three threads. When the bolt was tightened up to the washers additional turning broke the bolt right off without affecting the threads in the bar of McAdamite. The aim of this test was to strip if possible the threads cut in the McAdamite. The National Sales Corporation, 296 Broadway, New York, is factory sales manager for McAdamite metal.

THE WHEELER CONDENSER & ENGINEERING CO., Cartaret, N. J., has made arrangements with Charles S. Lewis & Company, Granite Building, Fourth and Market Streets, St. Louis, Mo., to handle "Wheeler" apparatus in the state of Missouri. This includes the well-known "Wheeler" surface, jet and barometric condensers, feed-water heaters, re-heaters and receivers, vertical engines, centrifugal pumps, rotating dry vacuum pumps, and vacuum pans and multiple effects. It also covers the "Voltz" combined condenser and feed-water heater, "Barnard-Wheeler" water cooling towers and the "Edwards" air pump, which has the unique distinction of replacing wet vacuum pump, dry vocuum pump and pre-cooler in condenser equipment. As the "Edwards" pump contains no suction valves, the pump is as effective in removing air as a dry vacuum pump having mechanically operated admission valves. This pump is widely applied for other vacuum work, as well as with condensers. It is built in various combinations, single, duplex and triplex for steam and electric drive, etc.

CIRCULAR LOOM IN CHELSEA FIRE.—In the recent disastrous conflagration at Chelsea, Mass., the plant in that place of the American Circular Loom Company, consisting of its Circular Loom factory, warehouse, stables and home offices, was completely destroyed. The plant was fully covered by insurance. The factory employees suffered severely; nearly all lived in the vicinity of the factory, and lost house and home and all they possessed. Some were injured and one—a young woman—was burned to death. The Circular Loom Company has already secured a new factory, excellently adapted to its needs, in North Cambridge, Mass., and has established new permenant offices in the International Trust Bldg., in the City of Boston. It is now actively engaged in assembling with all possible speed new machinery for the manufacturing of "circular loom," and hopes to be able to supply the demand again regularly and promptly within a very short time. Until new general offices were established, there was some delay in transacting business connected with the company's "Electroduct" factory at Kenilworth, N. J., which is in full operation, and its new metal-molding factory, also located at Kenilworth, N. J. The latter is now fully completed, including a large electro-galvanizing plant, and metal molding will be offered to the trade as soon as the necessary printed matter, which was stored at the home offices and burned up, can be duplicated.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 14, 1908.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

884,353. ELECTRIC SWITCH; Herbert Henry Berry, Enfield, Eng. App. filed Dec. 16, 1905. Electric switch device enclosed in a metal or other protective case and having a hinged lid or cover which must be first closed down before the switch fuse can be brought into contact with the live circuit.

884,367. ELECTRICAL WATER HEATER; Edward J. Condon, New York, N. Y. App. filed June 8, 1907. Water heater of the type having a plurality of serially connected tubes through which the water flows and in which the electric current is carried by pipes within the tubes and constituting resistance elements. Has a varied control which may be accomplished through a single operating handle.

884,381. TELEGRAPH TRANSMITTER; Mark S. Haling, Weaver, Minn. App. filed May 22, 1906. Transmitter of the type making use of two keys fulcrumed on vertical axes and which operate to transmit dots and dashes successively in a continuous succession as long as depressed.

884,397. OVERHEAD TROLLEY; Allen P. Lord and Nathaniel Wilkens, Bradford, Pa. App. filed Jan. 11, 1907. Construction of trolley wheel having fixed webs or flanges on the harp, which extend above the rim of the trolley wheel to serve in place of the usual guiding flanges of the wheel.

884,424. ELECTRICAL FLUID HEATER; Mark T. Seymour, Bemus Point, and Alton W. Ball, Stowe, N. Y. App. filed Dec. 2, 1907. A tool for heating oil wells, making use of a cylindrical casing which is dropped into the well so as to permit a circulation of fluid therethrough. Includes a central rod formed of serially connected resistance elements to heat the fluid within the cylinder.

884,458. ELECTRIC CURRENT REGULATOR; Arthur W. Brice, Rochester, N. Y. App. filed March 20, 1905. A form of rheostat or controller adapted to be embodied in a lamp socket for the purpose of controlling the illumination of miniature electric lamps and other devices which require only a few volts for their use.

884,463. METHOD OF MAKING REFRACTORY ARTICLES; Charles F. Burgess, Madison, Wis. App. filed May 31, 1906. An electric furnace for making crucibles and the like of refractory materials, and including two concentric electrodes between which the refractory crucible material is molded and vitrified.

884,466. SWITCH BOX; Thomas J. Cleland, Chicago, Ill. App. filed June 3, 1905. Provides a switch comprising two members entirely separable from one another, but which, when fastened together, entirely enclose the contact parts in a box-like structure.

884,499. ELECTRIC SPARK GAP FOR INTERRUPTERS; Thomas B. Kinraide, Jamaica Plain, Mass. App. filed April 24, 1906. Automatic means for blowing out the spark of a circuit breaker quickly, which consists in interposing between the discharge surfaces an explosive gas which detonates and blows out the arc which is formed. Makes use of water vapor which explodes into steam.

884,500. TELEPHONE DESK-STAND; Anton M. Knudsen, Chicago, Ill. App. filed Sept. 2, 1904. In a desk stand, the combination with a hollow standard and a thin metal supporting base, of an interior base having an aperture through which the lower end of said standard extends, said base providing means to secure apparatus within the base without marring the exterior surface of the outer base, substantially as described.

884,501. MEANS FOR MEASURING THE DEGREE OF EXPOSURE OF A SELENIUM-CELL; Arthur Korn, Munich, Germany. App. filed Aug. 1, 1906. Makes use of a galvanometer for indicating the degree of exposure of a selenium cell to light. Intended to equalize the influence of the inertia after the effect of light produced in the selenium cell. Apparatus for use in photometry and other applications.

884,511. SELF STARTER; Walter O. Lum, Schenectady, N. Y. App. filed Aug. 6, 1906. A series of switches arranged to successively short-circuit sections of starting resistance, and actuated by solenoids or other electromagnetic means, each solenoid having two windings, one for holding the switch in a closed position, and the other to operate the switch.

884,514. AUTOMATIC ELECTRIC SWITCH; Andrew H. Miller, Chesaning, Mich. App. filed March 30, 1903. A means for periodically flashing a lamp for signs and the like, making use of a heating element in the base of the lamp, which shunts the filament whenever it becomes cool, and vice-versa.

884,517. CONDUIT ELECTRIC RAILWAY; Lewis Wells Musick, Crescent City, Cal. App. filed Aug. 9, 1906. The patentee makes use of specially constructed depending rollers on the car truck, which engage a trolley supported in the form of a conduit beneath the track surface.

884,519. FUSE HOLDER FOR ELECTRIC CIRCUIT CONDUCTORS; Patrick McDonald, Rochester, N. Y. App. filed Oct. 2, 1905. The fuse element is contained between a pair of metallic cups having a spring member in one side wall and engaging a notched portion of the insulating tube of the fuse.

884,540. ELECTRIC HEATER; Elihu Thomson, Swampscott, Mass. App. filed Oct. 13, 1906. An electric heater for use with comparatively high potentials. The heating resistance is immersed in oil having a high flashing point. In order to circulate the oil the patentee makes use of a pump which flows the oil through a form of water-cooled condenser.

884,541. SYSTEM OF CONTROL FOR ELECTRIC MOTORS; Leonard A. Tirrill, Lynn, Mass. App. filed Feb. 8, 1906. Control system for eelectric motors adapted to be reversed frequently and quickly under load, for example, in operating a planing machine. This service is very severe on the motor on account of the momentum and inertia and other reasons. Provides a type of controller adapted to make the reversing action as easy on the motor as possible.

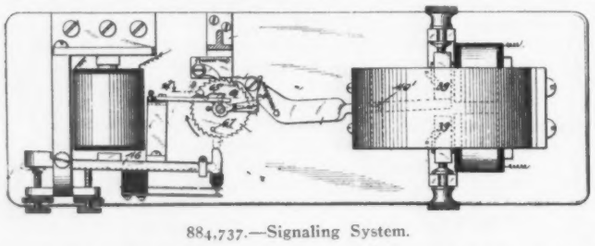
884,546. TROLLEY WHEEL; Frederick G. Walker, Cleveland, Ohio. App. filed May 12, 1906. The trolley wheel is made in two longitudinally divided sections or parts between which oil may exude from a chamber within the trolley wheel, so as to keep the tread lubricated.

884,555. REGULATION OF DYNAMO ELECTRIC MACHINES; Charles E. Barry, Schenectady, N. Y. App. filed Sept. 20, 1905. A construction of dynamo electric machine having a main field winding, an iron resistance in series therewith, and an opposing field winding in shunt to said resistance.

884,563. PROCESS OF FUSING MATERIALS; George F. Brindley, Niagara Falls, Ontario, Canada. App. filed March 13, 1906. A process of fusing corrosive material consisting in fusing without decomposing the same in the presence of air by the maintaining of an alternating current of low density in the fused material in contact with the electrodes and of a high density in that part of the bath where the unfused material is added to the mass.

884,595. CARRIER SYSTEM; Sam H. Libby, East Orange, N. J. App. filed June 17, 1905. A carrier system in which each carrier is provided, not only with a driving motor, but also with a hoisting motor and with a control system adapted to control both the driving and the hoisting motors.

884,607. TELEPHONE FIRE-ALARM SYSTEM; William S. McLewee, Yardley, Pa. App. filed April 9, 1906. Diagram of circuits



884,737.—Signaling System.

adapted to telephone subscribers in order to give a fire-alarm signal over usual telephone circuits.

884,624. SOCKET CAP; W. S. Stapley, Bridgeport, Conn. App. filed Oct. 22, 1907. Socket cap, comprising an internally threaded metallic sleeve with a reduced portion, which is riveted over the shell so as to form a unitary structure therewith.

884,630. TROLLEY POLE AND HEAD; August F. Bauer, Philadelphia, Pa. App. filed Nov. 27, 1907. In place of the usual trolley pole and harp, the patentee has an upright on the car roof with a pair of pivoted arms, which are spring impelled toward one another, and which carry separate trolley wheels.

884,641. HANGING INSULATOR; Walter G. Clark, New York, N. Y. App. filed Oct. 6, 1906. An insulator for high potential currents, making use of a series of petticoats which are self-supporting from a cross arm above. The conductor is attached to the lowermost insulator.

884,644. SYSTEM FOR ELECTRIC RAILWAYS; Arthur C. Eastwood, Cleveland, Ohio. App. filed Oct. 25, 1906. A control conductor arranged along a track and divided into sections of such length that two trains cannot be operated upon the same section at the same time.

884,645. SYSTEM FOR ELECTRIC RAILWAYS; Arthur C. Eastwood, Cleveland, Ohio. App. filed Feb. 2, 1907. Provides an electric railway, which may be operated without the use of large central power plants and without the necessity of installing an expensive system of transmission conductors. Makes use of a turbine-driven generator in a special car, operated by a steam connection from the locomotive.

884,646. ELECTRIC RAILWAY; Arthur C. Eastwood, Cleveland, Ohio. App. filed Feb. 23, 1907. Provides means whereby neighboring sections of a control conductor will be automatically coupled together with the train in passing from one section to another, and will be automatically uncoupled when the transition from one section to another is completed.

884,653. ELECTROLYTIC CELL; George A. Gabriel, New York, N. Y. App. filed Nov. 23, 1906. In an electrolytic cell, metallic plates forming the sides of said cell, said plates having offset or outwardly extending portions forming closed cathode chambers, the cathodes being situated over the recesses formed by said offset portions.

884,664. DEPOLARIZER FOR GALVANIC BATTERIES; Ernest Waldemar Junger, Kneippbaden, Norrkoping, Sweden. App. filed May 14, 1907. A depolarizer for galvanic elements, comprising nitrosulfuric acid dissolved in concentrated sulfuric acid.

884,681. SHOE; Adam Reed and David A. Reed, Los Angeles, Cal. App. filed June 29, 1907. A construction for the sole of a shoe, making use of copper and zinc plates and a cement forming an electrolyte therefor.

884,684. TROLLEY HARP AND WHEEL; Edward D. Rockwell, Bristol, Conn. App. filed June 1, 1906. The patentee has a trolley harp with square journal boxes in which are removably received the bearings for the wheel. The latter have special lubricating features and spring blades to establish a good contact with the wheel.

884,705. SOLVENT FOR METALS; Edward C. Broadwell, Chicago, Ill. App. filed Feb. 28, 1906. A metal solvent, comprising a mononitrosulfonic acid and a suitable haloid salt.

884,737. SIGNALING SYSTEM; Edward E. Kleinschmidt, New York, N. Y. App. filed March 7, 1906. Has track signal with two circuits directly controlling and setting said signal, and a switch, comprising rotatably mounted fingers, and means to position said fingers to close the corresponding circuit to set the signal at danger or safety.

884,738. SIGNALING SYSTEM; Edward E. Kleinschmidt, New York, N. Y. App. filed Sept. 1, 1906. Selective signal switches included in a single line circuit, and only set by the controller at the dispatcher's office, instead of being both set and cleared as in previous systems. When a signal is set, the motorman receives his instructions by telephone and manually clears the signal when told to do so, provision being made to advise the dispatcher by signal when the track has been cleared.

884,750. TROLLEY; Louis C. W. Mitchell and John A. Fretz, Philadelphia, Pa. App. filed March 27, 1906. The trolley harp is swiveled on a vertical axis at the top of the pole by a ball-bearing connection.

884,763. ELECTROLYTIC REDUCTION OF METALLIC COMPOUNDS; Hugh Rodman, Philadelphia, Pa. App. filed May 17, 1902. The process of reducing iron oxid, which consists in subjecting the same to electrolysis as a cathode in an electrolyte containing a soluble sulfid, substantially as described.

884,775. ELECTRIC SWITCH; Adolph R. Swoboda, Louisville, Ky. App. filed March 8, 1905. A knife blade switch constructed of sheet metal stampings and designed to give a wedging engagement between the blade and the spring clips.

884,783. SIGNAL SYSTEM FOR RAILWAYS; Maximillian G. Voigtlander, Harrison, Ohio. App. filed Aug. 9, 1906. A signal alarm system for use with an installation in which contacts on the car make periodical contacting engagement with conductors along the track.

884,784. SIGNAL SYSTEM FOR RAILWAYS; Maximillian G. Voigtlander, Harrison, Ohio. App. filed Aug. 9, 1906. Relates to modifications of the above.

884,831. ALTERNATING CURRENT GENERATOR. Carl A. Lohr, Wilkinsburg, Pa. App. filed Feb. 2, 1906. In combination with two alternating current lines of different frequency, and an alternating current generator having alternating current windings on both of its members, means for alternately connecting at will the windings of both members of said generator to one of said alternating current lines, or the winding of one member of said generator to the other of said alternating current lines, having the winding of the other member of said generator closed upon itself.

884,843. MONEY DRAWER ALARM; Sillus Da Costa Newman, Jellico, Tenn. App. filed June 3, 1907. Makes use of a specially constructed circuit closing device in connection with a money drawer, and which is capable of use by authorized persons without giving an alarm, by special manipulation.

884,969. THERMOSTATIC CIRCUIT CLOSER; Jay O. Woods, Riverside, Wash. App. filed Oct. 5, 1906. A controller for incubators, making use of a thermometer with a plug in the bore, which closes a circuit in case a predetermined temperature is exceeded, which circuit energizes a magnet to deflect the hot air from the lamp into a flue outside the chamber of the incubator.

884,978. CUT-OUT; John H. Booth, Frank E. Blausey and Arthur M. Smith, San Pedro, Cal. App. filed Jan. 19, 1906. Protective apparatus for telephone and other low-tension circuit apparatus, to guard against lightning and other currents. Includes a pair of hinged sheet metal arms with forked extremities, in which may be engaged the ends of specially constructed fuse elements.

884,981. SEPARABLE ATTACHMENT PLUG; Owen E. Kenny, Toledo, Ohio. App. filed March 16, 1906. A plug for drop or extension cord, having two separable parts with metallic sheet metal hooks, which engage to make an electrical and mechanical connection by a manipulation analogous to fastening a bayonet joint.

884,919. PROCESS FOR MAKING NITROGEN OXIDS FROM AIR; August Grau and Franz Russ, Vienna, Austria. App. filed Oct. 8, 1907. The process of making nitrogen oxids from the air by passing air into an electric arc flame and withdrawing the treated gases directly from the central zone of the electric flame, substantially to the exclusion of gases from the outer zones and immediately cooling the said gases.

884,920. APPARATUS FOR MAKING NITROGEN OXIDS FROM AIR; August Grau and Franz Russ, Vienna, Austria. App. filed Oct. 8, 1907. In apparatus for the manufacture of nitrogen oxids from the air in combination with the rest of an electric furnace for producing the arc flame, a tubular electrode and exit tube for the treated gases of substantially the same diameter as the inner zone of the arc flame.

884,930. ELECTRODE FOR REVERSING GALVANIC BATTERIES; Ernst W. Jungner, Knippbaden, Norrköping, Sweden. App. filed Sept. 20, 1904. An electrode for secondary batteries having an alkaline electrolyte, said electrode containing an active mass mixed with small particles of carbon having a thin coating of a metal that does not occlude oxygen and that is insoluble in the electrolyte.

884,986. WIRELESS TELEGRAPHY; Guglielmo Marconi, London, England. App. filed Nov. 28, 1902. At a receiving station in a wireless telegraph system, the combination of a core of magnetic material, means for producing a varying magnetic field in said core, and means inductively affected by the core for receiving oscillations.

884,987. WIRELESS TELEGRAPHY; Guglielmo Marconi, London, England. App. filed Feb. 2, 1903. At a receiving station in a wireless telegraph system, an oscillation receiving conductor, a magnet for creating a magnetic field, a magnetizable member located in said magnetic field and connected to said conductor, means for moving the magnet to and from the magnetizable member, and a receiving instrument affected by the changes in magnetism of the magnetizable member, whereby oscillations received from a distant transmitting station are rendered intelligible as signals.

884,988. DETECTING ELECTRICAL OSCILLATIONS; Guglielmo Marconi, London, England. App. filed Feb. 2, 1903. The method of detecting electrical oscillations, which consists in receiving said oscillations by means of a coil maintained in a magnetic field, which field is created independently of received oscillations and of the apparatus which renders received oscillations intelligible.

884,989. WIRELESS TELEGRAPHY; Guglielmo Marconi, London, England. App. filed Feb. 9, 1904. In a wireless telegraph system, the method of detecting electrical oscillations of high frequency, which consists in creating a rotating magnetic field at a receiving station, abruptly varying said field by the received oscillations, and utilizing the variations in said field to create intelligible signals.